340091

JPRS 84638

27 October 1983

USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

No. 75

FBIS FOREIGN BROADCAST INFORMATION SERVICE

6
71
AØ4

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service (NTIS), Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semimonthly by the NTIS, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS REPORTS

Japan Report
Korean Affairs Report
Southeast Asia Report
Mongolia Report

Near East/South Asia Report
Sub-Saharan Africa Report
West Europe Report
West Europe Report: Science and Technology

Latin America Report

USSR

Political and Sociological Affairs
Problems of the Far East
Science and Technology Policy
Sociological Studies
Translations from KOMMUNIST
USA: Economics, Politics, Ideology
World Economy and International Relations
Agriculture
Construction and Related Industries
Consumer Goods and Domestic Trade
Economic Affairs
Energy
Human Resources
International Economic Relations
Transportation

Physics and Mathmetics
Space
Space Biology and Aerospace Medicine
Military Affairs
Chemistry
Cybernetics, Computers and Automation Technology
Earth Sciences
Electronics and Electrical Engineering
Engineering and Equipment
Machine Tools and Metal-Working Equipment
Life Sciences: Biomedical and Behavioral Sciences
Life Sciences: Effects of Nonionizing Electromagnetic Radiation
Materials Science and Metallurgy
Meteorology and Hydrology

EASTERN EUROPE

Political, Sociological and Military Affairs
Scientific Affairs

Economic and Industrial Affairs

CHINA

Political, Sociological and Military Affairs
Economic Affairs
Science and Technology

RED FLAG
Agriculture
Plant and Installation Data

WORLDWIDE

Telecommunications Policy, Research and Development
Nuclear Development and Proliferation

Epidemiology

FBIS DAILY REPORT

China
Soviet Union
South Asia
Asia and Pacific

Eastern Europe
Western Europe
Latin America
Middle East and Africa

To order, see inside front cover

JPRS 84638

27 October 1983

USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

No. 75

CONTENTS

 [III - USSR - 21C S&T]

CONFERENCES

PUBLICATIONS

MICROELECTRONICS AND COOPERATION OF CEMA COUNTRIES

Moscow MALYYE VYCHISLITEL'NYYE MASHINY (NOVOYE V ZHIZNI, NAUKE, TEKHNIKE: SERIYA "RADIOELEKTRONIKA I SVYAZ'") in Russian No 2, Feb 83 (signed to press 24 Jan 83) pp 61-62

[Article by Corresponding Member of USSR Academy of Sciences D. Zhimerina, First Deputy Chairman of USSR State Committee on Science and Technology from the book by Doctor of Technical Sciences, Professor Yevgeniy Pavlovich Balashov, Chairman of Leningrad Oblast Administration of All-Union Scientific Medical and Technical Society, and Candidate of Technical Sciences, Docent Arkadiy Petrovich Chastikov, Izdatel'stvo "Znaniye", 39,540 copies, 64 pages]

[Text] The accumulated experience of the coordinated efforts to develop and use the latest technology indicates the importance of further expansion and development of cooperation of the socialist countries. This is especially necessary now when computer technology has gained a new impetus for development. At its 35th conference, the 1981 session of CEMA decided to work out a program of cooperation on the problem of development and widespread use of microprocessor technology in the national economy during 1982-1990.

To execute this decision, the Secretariat of CEMA prepared a draft of a program which was considered and approved by the CEMA committee on scientific and technical cooperation. A general agreement was concluded in June 1982 on cooperation of CEMA members in the field of microelectronics. It provides for joint investigations on organization of cooperative production of a wide nomenclature of automated production complexes, machines and devices equipped with microprocessor program control devices.

The agreement provides for generalization of the accumulated experience on the use of microprocessor equipment and conducting of scientific research and experimental design work to develop microprocessor devices. Special attention is devoted to training of personnel and measures are planned on training and retraining of specialists of higher and secondary level of qualifications.

The program of cooperation contains more than 70 specific topics (tasks) and 52 pilot (standard) complexes and articles equipped with microprocessor devices should be developed prior to 1990 and 28 complexes and products will be delivered for serial production. Organization of development of typical microprocessor systems by CEMA members will make it possible to accelerate

their development by duplication and will make it possible to accelerate their development on similar automated complexes.

According to preliminary estimates, the saving of implementation of the program during the period up to 1990 will comprise approximately five billion rubles. The saving will be achieved by an increase of labor productivity and by improvement of the product quality and by expansion of the functional capabilities and flexibility of control.

6521
CSO: 1863/222

COMPUTER MAINTENANCE CONTRACT PROBLEM DISCUSSED

Moscow EKONOMICHESKAYA GAZETA in Russian No 21, May 83 p 13

[Letter from V. Laletin, senior legal adviser to "Uralkhimmash" Production Association, and V. Belykh, senior instructor, Department of Economic Law, Sverdlovsk Juridical Institute: "Who Will Maintain the Computer?"]

[Text] Who will maintain the computer? The "Uralkhimmash" Production Association has been looking for the answer to that question at various levels for several years now. The time has passed, but nobody has helped the association get a maintenance contract. But, let's start at the beginning....

In 1979, "Uralkhimmash" acquired a YeS-1022 computer and decided at once to use the help of a specialized organization providing centralized maintenance. There is such an organization in Sverdlovsk: the Ural Specialized Territorial Administration (USTU). But this administration refused to contract with "Uralkhimmash," apparently considering itself free to choose who gets its services.

The computer maintenance issue was decided at the ministerial level by the Ministry of the Chemical Industry and the Ministry of the Radio Industry. The Ministry of Chemical & Petroleum Machine Building was informed that the "Uralkhimmash" request for YeS-1022 computer maintenance may be approved in 1981. But despite the fact that the production association, to which the USTU [Ural Specialized Territorial Administration] is subordinate, ordered the administration three times to issue the computer maintenance contract, it has avoided doing so.

Who, then, will maintain the computer?

In our view, the need of adopting a special normative act regulating relations on performing comprehensive centralized computer maintenance has long been ripe. Without it to regulate organization of business relations for computer maintenance, the parent organizations for the provider and client apparently have the right to solve this problem.

8545
CSO: 1863/189

MINISTRY OF ELECTRONICS INDUSTRY RESPONDS TO CRITICISM OF COMPUTER MAINTENANCE, PRODUCTION

Moscow EKONOMICHESKAYA GAZETA in Russian No 24, Jun 83 p 2

[Letter from P. Stukolov, chief, GlavPEU [not further identified], Ministry of Electronics Industry, in response to review, "From Microprocessors to OGAS [Statewide Automated Network]," (No. 13, EKONOMICHESKAYA GAZETA)]

[Text] On the review, "From Microprocessors to OGAS [Statewide Automated System]," (No. 13):

Having discussed the review, the Ministry of the Electronics Industry wishes to report that the state-of-the-art in microelectronics technology has allowed organizing mass production of microprocessors and microcomputers used in building microprocessor systems for various applications. To speed up the process of introducing them, we have set up a network of regional technical consulting centers responsible for organizing efforts and analyzing fields of application and volumes of demand for microprocessor units in computer hardware being produced by the industry.

Maintenance is currently performed by departments for introduction in the manufacturing enterprises and a number of regional enterprises in which departments and bureaus have been set up for warranty repairs and post-warranty maintenance of the "Elektronika-60" microcomputers. For organization of centralized maintenance, the "Statute on Maintenance for Users of Microprocessor Hardware Produced by the Ministry of the Electronics Industry" has been drafted; it provides a comprehensive solution to this problem."

8545
CSO: 1863/189

MINISTRY OF RADIO INDUSTRY RESPONDS TO CRITICISM OF COMPUTER MAINTENANCE, PRODUCTION

Moscow EKONOMICHESKAYA GAZETA in Russian No 26, Jul 83 p 2

[Letter from N. Gorshkov, deputy Minister of the Radio Industry, USSR, in response to review, "From Microprocessors to OGAS [Statewide Automated Network]," (No. 13, EKONOMICHESKAYA GAZETA)]

[Text] The Ministry of the Radio Industry discussed the criticism printed in the review, "From Microprocessors to OGAS [Statewide Automated Network]," published in the EKONOMICHESKAYA GAZETA.

In the industry, programs to enhance SVT [computer hardware] reliability, quality and technical standards and to develop peripherals and terminals and put them into series production have been approved. These programs define developments and assimilation of more than 70 types of data preparation and input/output units, external storage units, subscriber stations, terminal systems and automated workstation complexes (of them, more than 40 types are for the period 1983-1985). The programs also provide measures aimed at improving the quality, reliability and technical standard of new peripherals, as well as further enhancing the maintenance standard for them, reducing energy and materials consumption, and expanding applications software.

As for comprehensive centralized maintenance of SVT [computer hardware], 60.4 percent of all computers in operation are now covered by enterprises under the Ministry of the Radio Industry throughout the country as a whole. The "Program to Enhance SVT [Computer Hardware] Reliability, Quality and Technical Standards" calls for ensuring, in the period 1983-1985, full satisfaction of computer user requests to put Unified System hardware and ARM [automated workstation] systems into operation, and increasing the rates of accepting computers for maintenance to 80 percent in 1985. A number of other measures on improving comprehensive centralized maintenance of SVT [computer hardware] are being taken.

8545
CSO: 1863/189

DIRECTOR OF INSTITUTE OF APPLIED MATHEMATICS INTERVIEWED

Moscow IZVESTIYA in Russian 12 Jul 83 p 3

[Interview with Academician A. N. Tikhonov, director of Institute of Applied Mathematics, and Academician A. A. Samarskiy, department chief, by P. Yur'yev: "A Journey into the World of Science: The Computer Serves Man"]

[Text] No engineering achievement has had such an effect on man's intellectual activity as the computer has. Having increased the arithmetic and logic operation execution rate tens and hundreds of millions times, computers have caused radical changes in information processing. In essence, we are witnessing an "information revolution", similar to the industrial revolution which began in the eighteenth century with the invention of the steam engine which sharply raised physical labor productivity. In our time, computers are penetrating literally all spheres of man's intellectual activity.

In our country, a prominent scientific group engaged in this field is the Institute of Applied Mathematics imeni M. V. Keldysh, USSR Academy of Sciences, which marked its 30th anniversary this year. It was named for its founder and first director, Academician M. V. Keldysh, awarded the Hero of Socialist Labor three times. At the request of our readers, the role of computers as the key factor in speeding up rates of scientific and technical progress and raising labor productivity, and the value of applied mathematics as the theoretical base for this process are discussed by Academician A. N. Tikhonov, institute director and Hero of Socialist Labor, and Academician A. A. Samarskiy, department chief and Hero of Socialist Labor.

"Almost forty years have passed since computers first appeared," Academician A. N. Tikhonov said in starting the discussion. "In this time with their help, we were able to begin carrying out major scientific and technical programs such as mastering nuclear energy and exploring space. We now have the third and fourth generation computers in operation in the computer centers. They significantly surpass their "ancestors" in throughput, memory and

interactive capabilities. They are used today to solve problems such as technology of production of materials with specified properties and optimization of chemical processes, automated design [CAD] and control of production, mineral prospecting and weather prediction. But even more difficult problems are on the agenda: controlled thermonuclear fusion, exploitation of ocean resources, environmental protection....

Take for example the problems of controlling a manufacturing process, chemical reactor or space flight. The computer has to respond immediately to questions during the process and operate, as they say, "in the real-time mode." In these cases, requirements for computer speed are extremely high: If a response is just a little late, something irreparable can occur.

It is difficult to overestimate the computer's role in solving ever more complex information problems. It is said that the modern scientist finds it easier at times to repeat scientific research already performed than to find a report on it in scientific publications. Therefore, an effort is now underway to create so-called computerized data banks, unique information depositories facilitating automated search and processing of information needed.

I would like to note one circumstance that at times escapes the nonspecialist's attention. Computers by themselves are just racks of electronics, magnetic disks and tapes for storing information, printers, plotters and others; they are, if one may say so, inanimate objects. But the "soul", or rather the "brain" of the computer is the software, i.e. the set of instructions and rules the machine "understands" which is used in executing operations on some input data to produce a response to a problem posed. Software is based on mathematical methods, the development of which makes up an extensive, rapidly developing division of applied mathematics. The main share of researchers whose work involves computers are now engaged in software development (both general and specialized for solving specific classes of problems). It is no coincidence that the relative share of a computer's "intellectual equipment" in the total cost is continually increasing and often exceeds hardware costs.

[Question] The term "computer experiment" is appearing more and more often in the specialized and popular literature. What is it?

[Answer] Academician A. A. Samarskiy: Theoretical research in the natural sciences, especially in physics, has always been based on a mathematical foundation, on computation of basic quantitative characteristics of the phenomenon under investigation. The set of equations describing an object of interest to us is called a mathematical model, while the study of its behavior under particular conditions by solving these equations is mathematical modeling. This name was acquired from analogy to full-scale physical modeling which had become widespread in engineering and which allowed replacing actual processes or constructions by smaller copies of them in studies. And even now, for example, builders of dams successfully design them by reproducing these gigantic hydroengineering structures in miniature, while aircraft designers have long "tested" models of future aircraft in wind tunnels.

But capabilities of physical modeling are limited: The more complex the object of study, the fewer the chances for success. For example, in aviation, for "slow-moving aircraft," tunnel tests yield fine results, but for modern high-performance aircraft, unfortunately, we cannot obtain all the information needed.

It is also rather evident that in studies, for example, of problems of controlled thermonuclear fusion or the ecology, small-scale modeling is ineffective, while increasing the modeling scale, on the one hand, requires enormous physical and time inputs, and on the other, is dangerous with unpredictable consequences. Or take the problems in astrophysics: formation of the universe, explosions of supernova stars, origin of the solar system.... Full-scale modeling in this case is impossible in principle. But mathematical modeling knows no such barriers; there would be a suitable mathematical model.

The complexity of the mathematical model is governed, as a rule, by the complexity of the object under investigation as well as by the degree of accuracy imposed by practice on the computation results. Also, model complexity should not exceed a certain limit defined by the capabilities of the mathematical apparatus available to scientists. This is the circumstance that held back use of mathematical models in science and technology in those times when mathematical problems had to be solved "manually." But simple models readily solved often did not meet the requirements of practice. With the advent of computers, the situation changed radically. The acceptable level of model complexity grew sharply and calculation results in many cases can now be used by engineers and designers.

By the way, to be fair, we should note that even now there are mathematical problems (and unfortunately, many of them) that are still beyond the capabilities of the most modern computers performing hundreds of millions of operations per second. Thus, designing effective mathematical models, as before, remains a difficult task requiring great skill. A successful mathematical model is half of the success. That is precisely why mathematical models are so thoroughly checked out and so meticulously proven with test experiments in modern research. And only when one becomes convinced that they describe reality rather well does the prediction phase begin: Now one can reliably predict behavior of the object in question under conditions where experiments have not yet been performed or were heretofore impracticable in general.

After what has been said, the meaning of the term "computer experiment" becomes very clear. It is the modern technology of theoretical research based on "experimenting" with a mathematical model, except that the role of laboratory equipment is performed by a computer which makes calculations according to a specified program.

[Question] In the history of science, there are cases when mathematics helped naturalists make remarkable discoveries. For example, in 1846, the French astronomer Leverrier discovered the planet Neptune "with the point of a pen." Can a "computer experiment" boast of something like that?

[Answer] Academician A. A. Samarskiy: In the state register of the USSR State Committee for Inventions and Discoveries under the number 55 is the discovery of a new physical effect, the T-layer. It was discovered during a "computer experiment." The essence of the effect is that in a relatively cold (low-temperature) plasma interacting with a magnetic field under certain conditions which have been established by calculations, high-temperature zones (thermal, current layers) may stably exist. The T-layer effect can be used, for example, in magnetohydrodynamic (MGD) power generators. Such a generator is now being developed.

Here is another example. A promising direction of laser technology is hardening the surface of metal parts by a laser beam. A group of scientists from the USSR Academy of Sciences Institute of Metallurgy imeni A. A. Baykov developed a device for this purpose. Radiation of parts in a nitrogen atmosphere was suggested. Preliminary evaluations indicated that the gas pressure must be about 100 atmospheres and this required complex, expensive apparatus. A "computer experiment" performed jointly by the Institute of Applied Mathematics and the Institute of Metallurgy allowed indicating more efficient conditions in which the laser beam intensity varies with time in accordance with a particular law. Thanks to this, it has become possible to reduce the power of the beam compared to what had been proposed and to lower the nitrogen pressure several fold. Such "mathematical design" allowed simplifying the apparatus and thereby saving quite a few resources.

Here it is being said now that mathematical problems posed by modern science and technology are becoming ever more complex. A basic cause of this is the so-called nonlinearity of equations describing particular processes. It is difficult to explain the essence of this mathematical concept without resorting to specialized terms. Some idea is given by this geometric analogy. If a straight line segment is drawn, it is easy to indicate its course at any point within the limits of the segment, even if it is quite small. But when the line is more complex, it is impossible to reconstruct it from individual fragments. To do this, we have to know the equation for the curve and how to solve it. Solving nonlinear problems on a computer (and as a rule, this is the only way possible to solve these problems) allows establishing new regularities in the surrounding world that are still unknown and often quite inevident from the positions of elementary "common sense." This is exactly why it is no exaggeration to say that in solving nonlinear equations, computers make discoveries every day.

[Question] In your opinion, what difficulties are there on the way to widespread introduction of computers in scientific research?

[Answer] Academician A. A. Samarskiy: Usually cited as the main obstacle is the lack of computers with adequate performance for our scientists. This is a significant factor, of course; but it is not the only one, and in my view, not even the determinate. A number of measures for developing high-performance computers are planned and being implemented in the country, particularly in the Academy of Sciences.

But besides the engineering aspect, much importance is attached to the question of how to most efficiently make use of this computer technology. One can say with certainty that even the pool of computers we now have is capable of supporting a substantially higher level of scientific research. There are several reasons for this.

Computer utilization efficiency in any field of science varies with the efficiency of its mathematical model. Most progress with respect to introduction of "computer experiment" methods has been achieved in physical research. This is no coincidence, since here the application of mathematical models has long traditions. Other scientific fields have been less ready to employ this new powerful means of theoretical analysis. Much effort needs to be applied in improving existing and developing new mathematical models in chemistry, biology and other sciences, especially economics.

There is yet another circumstance. Enthusiasm for extensive mathematicization of knowledge is not shared by all. Having become accustomed to working by the old ways, some scientists do not approve of the new technology bearing additional cares and concerns. At times, we also see the opposite trend. Having a computer is equated to prestige and a director will rush into acquiring a computer without laying the foundation for using it. Then the expensive hardware sits idle or is operated below capacity while there is perhaps a shortage in another place.

Also seen at times is an incorrect understanding of the computer's role. No computer is capable, as some naively think, of replacing the creative activity of a scientist, designer or organizer of production. A computer is just a tool, though very powerful, still a tool. It allows solving a problem put to it better, faster and with higher quality. But the statement of the problem is the prerogative of man who has mastered computer technology. First of all, he has to be a specialist in his own field. Turning to the computer for help, he must clearly understand what he expects of it. Then he must know the features of the mathematical statement of problems to be solved by it and introduce the capabilities of the computer.

In general, the problem of having enough skilled personnel able to apply modern computers in science and the economy is very critical and has to be solved without delay.

Required for this, first of all, is some restructuring of higher education. And the curricula change must affect not just the training of future mathematicians, but also to an even greater extent the training of instructors for the non-mathematical specialties (chemists, biologists, medical personnel, economists, etc.). Future specialists in any field must study the language of mathematics which has now become interdisciplinary to be able later to formulate their problems in it.

[Question] We know that not just scientific research institutes are using computers. The latest achievements in computer hardware, applied mathematics and software are being actively introduced in industry. Tell us about these new directions.

[Answer] Academician A. N. Tikhonov: Conveyors and automatic lines have been used in industry for a relatively long time, but they are designed for mass production of large lots of products. At the same time, with the diversity of requests imposed on industry by modern life, production of small series and individual products is also needed. In this case, it is difficult to depend on automatic lines: Too much time and resources will be spent on readjusting the machine tools. Banking on manual production is also unwarranted because of the critical shortage of skilled machine operators. In this case, fundamentally new approaches are needed.

That is how the concept of "flexible automated production" originated. It means first of all manufacturing flexibility, i.e. the capability of swiftly reconfiguring production and enabling output of a new variety with the same machine tools. It is equipped with machine tools with individual computers and also includes automatic transport-warehouse systems, equipment diagnostic systems, etc. Efficient operation of this entire complex is possible only when all links in the chain, from the designer to the operator controlling the equipment, are automated. And needed for this in turn is development of extensive software that links the entire complex together and allows harmonious operation of all its parts.

This is precisely the task assigned to the group at the Institute of Atomic Energy imeni I. V. Kurchatov: to develop an integrated computer-aided design and manufacturing system under the conditions of pilot production based on using domestic equipment. Elaboration of mathematical principles of operating this system and incorporating these principles in software were entrusted to the USSR Academy of Sciences Institute of Applied Mathematics imeni M. V. Keldysh. The creative group from the two institutes who has taken on this effort is striving to work out solutions that can be broadly applied in both other institutes and design bureaus.

How do things stand today? A demonstration system has been developed and has much promise; it has allowed checking the basic ideas and solutions, understanding the difficulties and selecting ways of overcoming them. This system enables visualizing the industry of the future.

The design bureau. Here there are no customary Kuhlman drafting units, rolls of Whatman paper or tracing paper.... The designer is comfortably seated in an easy chair in front of a screen resembling a television. An order for urgent manufacture of a new part has come in. After the designer keys in a command by using his keyboard, an image of a geometric body resembling the required part, called by the system from an archive, shows up on the screen. Using a light pen, the designer adjusts the dimensions, corrects the configuration and the drawing is ready. No need to waste time on erasing erroneous lines, or drawing standard assemblies: This is done automatically by special devices and programs. A push of a key and the drawing shows up on the engineer's screen. Again, a brief dialog with the computer which offers its advice but unconditionally agrees with the specialist's decisions. Thus, a machine tool or instrument is selcted, machining conditions are established,

etc. Another command to the computer and the drawing is sent from the engineer's screen to a microprocessor in a numerically controlled machine tool where it is "converted" into a program to make the part designed by a man with the computer's aid.

This future is now becoming an actual task that has to be performed by Soviet science and technology. This was referred to in the speech by comrade Yuriy Vladimirovich Andropov at the June (1983) Plenum of the CPSU Central Committee: "We have to implement automation of production and ensure the broadest use of computers and robots and introduction of flexible technology that allows rapidly and efficiently reconfiguring production to make a new product."

8545
CSO: 1863/189

SM AND ELEKTRONIKA S5 COMPUTERS

Moscow MALYYE VYCHISLITEL'NYYE MASHINY (NOVOYE V ZHIZNI, NAUKE, TEKHNIKE: SERIYA "RADIOELEKTRONIKA I SVYAZ'") in Russian No 2, Feb 83 (signed to press 24 Jan 83) pp 2, 28-31,45, 50-56

[Excerpts from book by Doctor of Technical Sciences, Professor Yevgeniy Pavlovich Balashov, Chairman of Leningrad Oblast Administration of All-Union Scientific Medical and Technical Society, and Candidate of Technical Sciences, Docent Arkadiy Petrovich Chastikov, Izdatel'stvo "Znaniye", 39,540 copies, 64 pages]

[Excerpts] Doctor of Technical Sciences, Professor Yevgeniy Pavlovich Balashov is the author of 18 monographs and 130 inventions. His scientific interest is philosophical problems of systems development and the methodology of design of information control and biological engineering systems. He is chairman of the Leningrad Oblast Administration of the All-Union Scientific Medical and Technical Society.

Candidate of Technical Sciences, Docent Arkadiy Petrovich Chastikov specializes in the field of computer equipment and ASU [automated control system] and is the author of more than 50 scientific papers. The range of his scientific interests include the history, contemporary state and principles of development of computer systems.

The reviewers are Doctor of Technical Sciences Eduard Vladimirovich Yevreinov and Doctor of Technical Sciences Vladimir Borisovich Smolov.

Annotation

The booklet acquaints one with the history of development of small computers, with the principles of organization of minicomputer architecture and with the structural organization of single- and multichip microcomputers. The characteristic features of the software of microcomputers and areas of application of the given class of machines are considered in it. The characteristics of the Soviet series of mini- and microcomputers, assembled in the form of tables, are presented at the end of the chapters.

The booklet is intended for engineers, students, lecturers and everyone who is interested in computer technology.

Soviet Series of Minicomputers

The important success of the scientists and workers of our country and of the socialist countries in the field of development and application of mincomputers makes it possible to summarize some results of development and to classify the results achieved.

As Corresponding Member of the USSR Academy of Sciences B. N. Naumov notes "the development of the first unit of the SM EVM [International Small Computer System] led to a significant increase of the technical level of small computers produced by socialist industry. The physical dimensions of the complexes were reduced sharply (approximately one-fifth as much), cost was reduced considerably (approximately one-half as much) and reliability indices were improved (approximately twofold). This was achieved by conversion to microprogram control in the processors,to the use of microcircuits with increased degree of integration and improved connector pins, the use of small-scale power sources, the use of the compact peripheral devices and improvement of the technological effectiveness of designs."

The specifications of models of the first unit of SM computers are presented in Table 1.

Table 1

	Models				
Characteristic	SM-1	SM-3	SM-2	SM-4	SM-5
Productivity (short operations), operations per second	$200 \cdot 10^3$		$400\text{-}500 \cdot 10^3$		10^6
Productivity (operations with floating point), operations per second	--				$250 \cdot 10^3$
Main memory capacity, Kbyte	4-32		16-128		6-256
Version of operating modes and of design formulation	Prolonged continuous operation with limited capabilities of preventive maintenance; for operation in production rooms and in aggressive media		Regulated conditions for preventive maintenance; for production rooms and under laboratory conditions.		Regulated preventive maintenance conditions; for operation in stationary rooms

Four models of processes of different productivity, the SM-1P--SM-P (Polish People's Republic, Cuba, Socialist Republic of Romania, USSR and CSSR), a number of systems of the main memory and system integration devices (People's Republic of Bulgaria, Hungarian People's Republic, Polish People's Republic, USSR and CSSR), which ensure design of systems with variable configuration

and wide range of characteristics, were developed in the work program of the first unit.

Models of the first unit of CM computers differ considerably in their technical level from predecesor computers of series ASVT-M [modular computer equipment system based on microelectronics], but they retain the program compatibility with the latter (SM-1 and SM-2 with M-6000 and M-7000 and SM-3 and SM-4 with M-400).

Considerable expansion of the nomenclature of minicomputers is provided in the models of the second unit of the SM computers with regard to the specialization in the hardware heirarchy. The structural and technological base of the models of the second unit are microprocessor complexes of BIS [large-scale integrated circuit] and circuits of increased scale of integration (8- and 16-digit microprocessor complexes based on n-MOS technology and microprocessor sections based on TTLSh [transistor-transistor logic with Schottky diodes] technology. The older models of the second unit have considerably higher productivity--several million operations per second with main memory capacity up to 1-2 Mbyte than models of the first unit of the SM computers, with similar economic indicators. Development of five new classes of models of the second unit of the SM computers (SM-50 to SM-54) is planned.

Besides development of new models of the second unit, development of a large number of new peripheral devices having high qualitative characteristics is planned.

The USSR State Prize for 1981 in the field of technology has been awarded to corresponding member of the USSR Academy of Sciences, work supervisor Boris Nikolayevich Naumov, Candidate of Technical Sciences Yevgeniy Nikolayevich Filinov, Candidate of Technical Sciences Yuriy Nikitich Glukhov, Candidate of Technical Sciences Aleksandr Nikolayevich Kabalevskiy, Candidate of Technical Sciences Stanislav Sergeyevich Zabar', Candidate of Technical Sciences Vladimir Porfir'yevich Fedorin, Candidate of Physicomathematical Sciences Valentin Petrovich Semik, Candidate of Physicomathematical Sciences Apollinariy Fedorovich Nezabitovskiy, Candidate of Physicomathematical Sciences Vila Antonovich Afanas'yev, Candidate of Physicomathematical Sciences Igor' Leonidovich Talov and Candidate of Physicomathematical Sciences Yevgeniy Borisovich Smirnov, by decree of the CPSU Central Committee and USSR Council of Ministers, for development and organization of serial production of SM-3 and SM-4 hardware and software complexes of the international small computer system (SM EVM).

Soviet Microprocessor Complexes

The typical microprocessor complex is a functionally complete set of BIS usually made by unified technology and designed for contruction of computer and control devices and systems of various functional designation based on them. A microcomputer complex usually contains a BIS, microprocessor, microprogram control, data exchange and main memory, ROM and semi-ROM. Besides the enumerated BIS of the baseline complex, additional BIS that accelerate data processing and increase the organizational effectiveness of the microcomputer

Table 2

Type of Micro-processor Complex	Type of Circuit or Number of BIS and Microprocessor Complex	Functional Designation of Circuit	Technology	Word Length, bit	Speed, μs	Consumed Power, W	Number of Instructions	Power Supply Voltage, V	Number of Registers
K536	14 BIS	Various	p-MOS	8	10.0	1.0	149	-24 to +1.5	--
K580	K580IK80	Microprocessor	n-MOS	8	2.0	0.8	78	±5 to +12	1/0/6
	K580IK24	Pulse generator	n-MOS	-	0.5	--	--	±5 to +12	--
K581	K581IK1	Arithmetic-logic unit	n-MOS	16	1.6	0.9	--	±5 to +12	0/0/26
	K581RU1	Microprogram memory	n-MOS	12	--	0.16	512	±5 to +12	--
K582	K582IK1	Processor component	IIL	4	1.5	0.2	--	--	0/1/10
K583	13 BIS	Various	IIL	8	1.0	0.3	--	1.2	--
K584	K584VU1	Central processor component	IIL	4	1.0	0.13	512	1.2	0/1/10
K587	K587IK2	Arithmetic-logic unit	CMOS	4	2.0	0.01	168	9	1/1/8
	K587IK1	Data exchange device	CMOS	8	1.5	0.01	60	9	--
	564RU24	Main memory for 256 bit	CMOS	1	2.5	--	--	--	3-15
K588	K588K2	Arithmetic-logic unit	CMOS	16	2.0	0.005	96	5	1/0/16
	K588IK1	Control memory	CMOS	-	2.0	0.005	--	5	--
K589	K589IK02	Central processor	TTLSD	2	0.15	0.85	--	5	1/0/11
	K589IK03	Accelerated carry circuit	TTLSD	8	0.02	0.4	--	5	--
	K589IR12	Buffer register	TTLSD	8	0.08	0.45	--	5	--

are provided in some microprocessor complexes. The supplementary complex may contain an accelerated carry BIS, an arithmetic expander BIS, priority interrupt BIS, direct memory access BIS, external equipment control BIS, two-way bus shaper IS [integrated circuit] and so on.

Besides hardware, a software and debugging hardware and software complex is being developed for microprocessor complexes.

The following basic directions can be determined in development of Soviet microprocessor technology: reproduction and development of the best foreign models, development of original Soviet BIS microprocessors and development of a unified microprocessor system (YeS MP).

Our industry has assimilated all modern technological processes for production of BIS. The speed of serial BIS microprocessors for different technologies comprises: 50,000 operations per second for p-MOS, 700,000 operations per second for n-MOS, 400,000 operations per second for CMOS, one million operations per second for IIL, two million operations per second for TTL and five million operations per second for ECL (speed is indicated for register-register type operations). The main characteristics of some Soviet BIS are presented in Table 2, where the characteristics of the microprocessor complex of single-chip and microprogrammable microprocessors are indicated. The symbol in the "word length" column indicates the capability of increasing the word length for microprogrammable microprocessors (n = 1, 2, 3 ...).

Microprocessor complexes of series K580, K582 and K586, containing single-chip microprocessors, are used more efficiently in design of digital automation devices and the simplest controllers, but can also be used to design micro- and minicomputers of different designation.

Microprocessor complexes of series K536, K581, K584, K587, K588 and K589 are designed primarily to construct microcomputers and complex controllers, but can also be used successfully for design of digital automation devices. Because of sectional organization, the use of microprogramming and mainline communications, they provide the capability of designing various computer and control systems. Microcomputers of the series Elektronika S5 and Elektronia 60 are made on the basis of complexes K536 and K581. Series K587 and K588 are designed to construct a number of compatible Elektronika NTs microcomputers. These series differ from all others by low consumed power and high noise stability which makes their use promising in microcomputers and controllers for production process control systems, in different assemblies and in facilities with heavy current switching. The speed of a microprocessor complex of type K589 is designed to construct microcomputers and high-speed automation systems. This complex is used extensively in development of hardware for Soviet control microcomputers of the SM EVM series.

Soviet Series of Microcomputers

Microcomputers of the Elektronika S5 family. The Elektronika S5 famility of 16-digit microcomputers is based on a complex of p-channel MOS BIS.

The family includes models of the Elektronika S5-01, Elektronika S5-02, Elektronika S5-11, Elektronika S5-12 and Elektronika S5-21. All the models are program compatible. The main specifications of the microcomputers of the Elektronika S5 family are presented in Table 3.

Table 3

Model	Speed, operations per second	Main memory capacity, words	ROM capacity, words	Overall dimensions, mm	Design version
Elektronika S5-01	$10\cdot10^3$	3K	2K	420x380x225	Multi-board
Elektronika S5-02	$10\cdot10^3$	10K	2K	460x415x245	"
Elektronika S5-11	10.10^3	128	1K	270x267x29	Single-board
Elektronika S5-12	$10\cdot10^3$	128	2K	298x284x30	"
Elektronika S5-21	$180\cdot10^3$	256	2K	309x244x29	"

The Elektronia S5-01 and Elektronika S5-02 are functionally and structurally complete devices and are designed mainly for use as debugging complexes for single-board modifications of the family. The indicated microcomputers can be used in information measuring systems as peripheral processors.

The block diagrams of Elektronika S5-01 and Elektronika S5-02 microcomputers consist of three main functional units: a microprocessor, memory system and input-output devices. The microprocessor includes a microprogram control arithmetic-logic device. The memory system includes a main memory and ROM control module with capacity of up to 20 K 16-digit words each. The input-output system consists of input-output control modules, teletype, consoles, input-output punches, electric typewriter, coupled adapter, display and analog-digital converter. Communication between individual functional modules is accomplished by means of address buses and information and control buses through an internal interface.

Two-byte instruction formats are used in the instruction system of the Elektronika S5 family and the following methods of addressing are employed: direct, indirect, with respect to instruction counter, index and autoindex. The addresses of the input-output channels are part of the common memory field. Access to the input-output channel is gained as to the memory cell.

The corresponding internal and peripheral software has been developed for microcomputers of the Elektronika S5 family. The internal software includes a dispatcher system, peripheral device controllers, standard microprogram library, standard subroutine library, resident translator from "autocode" type language and preventive maintenance tests. The dispatcher program provides

organization of real-time problem solving, control of the operation of periphal devices and the multiprogramming mode. The use of a standard microprogram library permits considerable expansion of the computing capabilities of microcomputers. The standard subroutine library provides calculation of standard trigonometric functions with single and double accuracy, conversion of various types of codes and a number of other generally used calculations. The resident translator from "autocode" type language permits the user programs to be debugged directly in the microcomputer. The preventive maintenance tests are designed to monitor the efficiency of individual devices and make it possible to localize a malfunction with accuracy up to a functional module. Along with the resident autocode translator, a resident translator from high-level BASIC language has been developed.

The peripheral software includes a cross assembler and loader for symbolic coding language, interpreters and programs for presentation of operational, technological and production documentation. The cross assembler permits the programs written in autocode to be translated into the machine codes of the microcomputer. The cross assembler is realized by the YeS computers within the DOS [disc operating system] and also on the BESM-6, M-220 and M-4030 computers.

The Elektronika 60 microcomputer. The Elektronika 60 microcomputer is designed for data processing and can be used in production process control systems, in testing and monitoring-measuring equipment and for scientific and technical calculations.

Besides the processor, the Elektronia 60 microcomputer may include input punch control devices. A Konsul 260 electric typewriter, FS-1501 photoreader and PL-150 punch are used as peripheral devices. Other peripheral devices--NGMD [not further identified], ATsPU [alphanumeric printer] and also user devices developed with regard to interface requirements.

The Elektronika 60 has the modular principle of design. Coupling between structurally complete modules is accomplished through a common data exchange channel. The configuration of the system is determined by the user and is dependent on its specific application. The data exchange channel connects the central processor (TsP), the memory and all peripheral devices. The channel (common bus) contains 39 communications lines, of which 32 are two-way. Communications between the two devices connected to the bus is accomplished on the "master-slave" principle. Asynchronous data transmission operations eliminate the need for timing pulses and permit exchange with maximum speed possible. Exchange between the two devices can be accomplished both in 16-digit words and in bytes. Data exchange between user devices in the computer can be accomplished in three different modes: unprogrammed exchange, program in the direct memory access mode and exchange in the program interrupt mode. The central processor of the Elektronika 60 controls the common bus and peripheral devices and performs arithmetic-logic operations. The processor contains eight 16-digit RON [not further identified], which can be used as storage as index registers and as stack pointers. Among the indicated RON, two are of special significance. RON 6 is used as a hardware stack pointer and RON 7 is used as an instruction counter.

The Elektronika NTs microcomputer. Computers of the Elektronika NTs series are a series of program-compatible microcomputers, oriented primarily toward application in real-time systems: in production process control systems, in monitoring control systems and in monitoring-measuring equipment control systems, for gathering and preliminary processing of data in information retrieval complexes, for solving engineering computing problems and also as peripheral programmable terminal controllers in computer complexes.

The input-output interface of the Elektronika NTs-03 microcomputer is compatible with the "common bus" interface of a number of SM computers.

Multiprocessor and multicomputer complexes, interacting through the "common bus" interface, can be organized on the basis of Elektronika NTs microcomputer. Additional memory units and additional specialized units can also be connected. Microcomputers of the Elektronika Nts series have a developed software system, which includes a cross-programming system realized on the BESM-6 computer, assembler, debugging system, text editor, standard program library and monitoring system. There is also a papertape operating system, which includes a control program, loader, directive reception and analysis program, memory control, input-output control, task control and communications with the operator.

The microcomputer is controlled from the console of the programmer engineer.

6521
CSO: 1863/222

GRAPHIC ELECTRONIC CONSOLE

Moscow STROITEL'NAYA GAZETA in Russian 3 Jun 83 p 3

[Unsigned article, "A Graphic Electronic Console", in the column "Discovered, Built, Introduced"]

[Text] The "SM 316" console is designed to display graphic, alphabetic, numeric and combined information on a CRT screen, for on-line editing of this information, and providing on-line user/computer interaction. The console can be used in a process control computer complex of a system of small computers (SM computers) and other computers in systems of automated design, automated scientific experiments and research, and automated management systems. It provides the user with extensive capabilities of display and multifunctional editing of high-density images, and creating multiple console automated work stations based on it.

For additional information, refer to the Institute for Electronic Control Machines (INEUM), at: Moscow, ul. Vavilova, 24.

9875
CSO: 1863/206

UDC 621.385.85

PROGRAMMABLE CONTROL DEVICE FOR MATRIX VIDEO SIGNAL SHAPERS ON CHARGE-COUPLED DEVICES

Moscow AVTOMETRIYA in Russian No 3, May-Jun 83 (manuscript received 7 Sep 81, final version received 28 Jul 82) pp 71-74

[Article by S. Ya. Afanas'yev, S. M. Borodin and V. Ya. Stenin, Moscow]

[Text] A device for controlling the operating conditions of matrix video signal shapers on PZS [charge-coupled device] ensures movement of charge files in matrix cells and their retrieval through a reader [1]. The variety of types of matrices and their formats in some cases makes feasible the development and use of a sufficiently universal control device, realization of which is quite possible at present existing restrictions on the number of elements in the PZS matrices (not more than 10^6) and the maximum readout frequencies of the output signal (up to 11 MHz). The matrix control algorithm can be accomplished by hardware on the basis of combination of modules with programmable characteristics and monitoring device that controls the interaction mode of the modules by program.

The universal nature of the programmable control device (PUU) is determined by the modular principle of its design, in which the logic conditions of interaction of the modules are established through the common communications line due to the effect of instructions generated by a microcomputer or controller with limited capabilities on the basis of a charge-coupled device, instruction counter and a device that realizes conditional transfers.

The basis of the programmable control device is a set of modules--programmable control channels (PKU), to each of which corresponds the register controlled by it or a section of registers of the PZS matrix. The designation of the programmable control channel is shaping a given number of pulses by a start signal that control the movement of charges according to the matrix register.

The block diagram of the programmable control device (Figure 1), designed on the basis of four programmable control channels, illustrates the version of the control device for PZS matrices containing and input register (VKh.R), output register (Vykh.R), storage section (SN), memory section (SP) and inter-register gates (Z1, Z3 and Z3). The block diagram of one programmable control channel module--PKU1--is shown in the same figure. The programmable control channel contains a set of units that include a phase signal shaper (FF), a

controlled filter (UP), programmable discriminator (PD), pulse counter (SI) and level converter (PU). By using logic program control of these units, they are readjusted to control modes for a matrix of specific type and format.

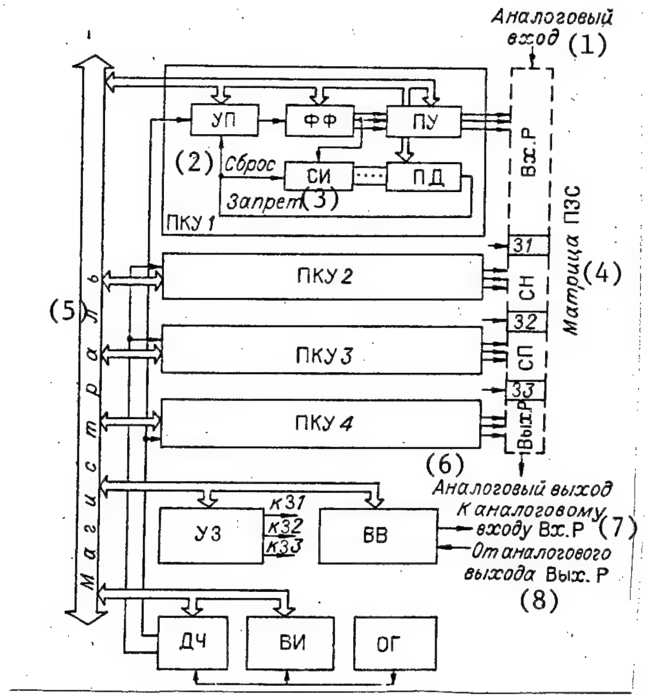

Figure 1. Block Diagram of Programmable Control Device with Four Programmable Control Channels Modules

Key:

1. Analog input
2. Dop
3. Forbid
4. PZS matrix
5. Bus
6. Analog output
7. To analog input Vkh.R
8. From analog output Vykh.R

The controlled filter admits or blocks the corresponding programmable control channel. The phase signal shaper converts the pulses of the reference frequency to a sequence of multiphase signals with the program task of their initial state. The programmable discriminator is a programmable digital comparator of the state of the pulse counter. The level converter of the output signal phase shaper matches the phase shaper to the registers of the matrix.

The number of programmable control channels modules required to construct a programmable control device is determined by the number of interacting registers and sections of registers of a specific matrix. In combination with the reference generator (OG), they form the minimum required hardware part of the programmable control device. Moreover, the hardware part of the programmable control device may contain an additional programmable frequency divider (DCh), that shapes the signals of the reference frequencies for the programmable control channel modules, a time interval control module (VI), an interregister

gate control module (UZ), which shapes the electric signals at the gates by instructions from the bus, and an electric data input-output control module from the matrix (VV).

Number	Instruction
1	Write number of lines in PD-SN
2	Write number of columns in PD-Vykh. R
3	Write number of lines in PD-SP
4	Set FF-SN(100), SP(100), Vykh. R(010)
5	Block UP-SN, SP, Vykh.R
6	Set UZ (Z2, Z3 = 1)
7	Set DCh mode
8	Write delay of 30 μs in VI
9	Start UP-SN, SP, Vykh.R
10	Read instructions PD-SP: "0"→ 10; "1"→ 11
11	Set UP-SP to transmission mode for three pulses
12	Block UP-SN, SP
13	Set FF-SN(100), SP(010)
14	Start VI (delay of 30 μs)
15	Count readings of VI: "0"→ 15; "1"→ 16
16	Set UZ (Z2, Z3 = 0)
17	Write delay of 175 μs in VI
18	Start VI (delay of 175 μs)
19	Count readings of VI: "0"→ 19; "1"→ 20
20	Write delay of 12 μs in VI
21	Set UZ (Z2, Z3 = 1)
22	Set Start VI (delay of 12 μs)
23	Start UP-SP
24	Count readings of VI: "0"→ 24; "1"→ 25
25	Set UZ (Z2, Z3 = 0)
26	Write delay of 52 μs in VI
27	Start VI (delay of 52 μs)
28	Count readings of VI: "0"→ 28; "1"→ 29
29	Set FF--Vykh.R (010)
30	Unblock UP-Vykh.R
31	Set zero state of counter UP-SP
32	Count readings of PD-SP: "0"→ 32; "1"→ 33
33	Set UZ (Z2, Z3 = 1)
34	Write delay of 560 μs in VI
35	Start VI
36	Count readings of VI: "0"→ 36; "1"→ 37
37	Go to "4"

The interaction between the considered modules of the system and the control device is accomplished through a common communication bus, the service life of which is distributed in the following manner [2]: common buses for two lines; power supply for four lines (two of +5 each, +12 and -12 V), 16 address lines and 16 data lines (A0-A15, D0-D15) and six control lines (data column--DS, verification--DK, direction of transfer--R/W, message format--F, stop of exchange--AB) and forbid selection--IS).

Different types and formats of matrices are controlled by sequential setting of the initial states, by starting, delay or blocking individual units of the modules of the device, which is accomplished through the main communications bus in a programmed sequence. Information about the format of the matrix and about a specific control mode is determined by program checking of the operation of the programmable control device modules, realized by the bus controller.

Let us consider the diagram of individual units of the programmable control channel module.

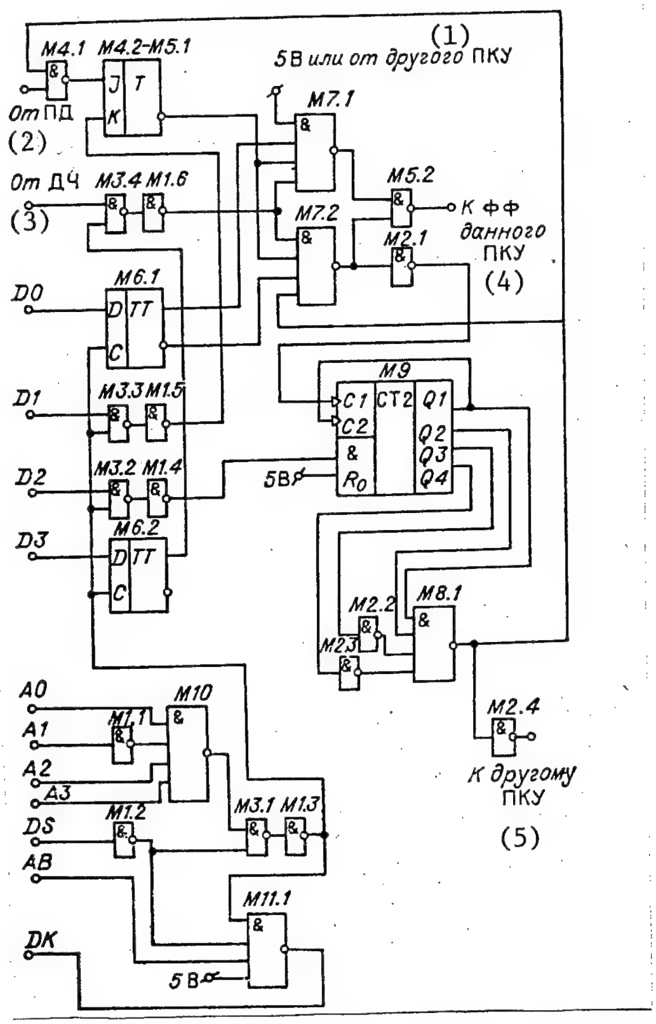

Figure 2. Diagram of Controlled Filter: M1 and M2--K155LN1; M3-M5--K155LA3; M6--K155TM7; M7 and M8--K155LA1; M9--K155IYe5; M10--K155LA2; M11--K11LA7

Key:

1. 5 V or from another programmable control channel
2. From programmable discriminator
3. From programmable frequency divider
4. To phase shaper of given programmable control channel
5. To another programmable control channel

The programmable filter (Figure 2) contains a logic filter of the reference frequency signals (M5.2 and M7) and subcircuits that ensure software (interface M1, M3, M6, M10 and M11.1) or hardware (M2, M4, M5.1, M8.1 and M9) control of the controlled filter. The controlled filter operates in two main modes: transmission of reference frequency pulses upon programmable start to blocking of the programmable discriminator by the signal and transmission of three reference frequency pulses for three-phase organization of the matrix registers after hardware start from another programmable control channel. The operating condition is determined by writing the code 1011_2 or 1010_2 for the first and second modes, respectively, from address of the controlled filter on buses D0-D15. An auxiliary mode of program setting of the zero state of counter M9 and program blocking of the controlled filter (corresponding code 0100_2) is also provided.

The phase shaper (Figure 3) is a sequential reversible register (M2.4, M3, M4, M8 and M9.1) that controls the phase recording unit (M5, M6 and M11). The phase shaper guarantees (through the corresponding interface M1.1-M1.4, M2.1-M2.2, M7, M10.1 and M12.1) software control of both the initial states of the pulse phases and of the charge transfer mode in the matrix (normal at F = 1) (charge is transferred from F1 to F3 and inversion at F = 0).

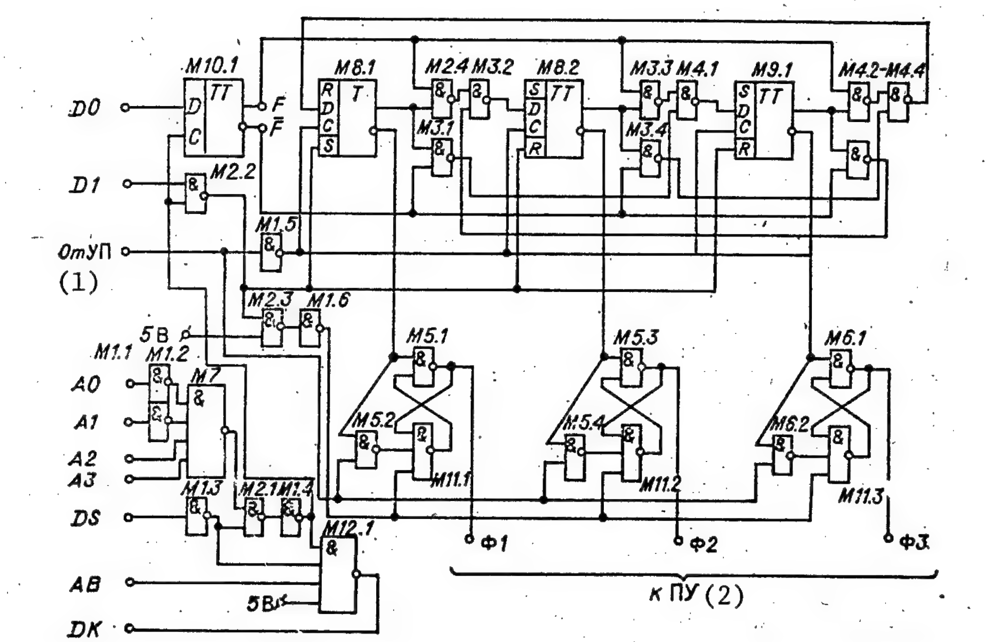

Figure 3. Diagram of Signal Phase Shaper: M1--K155LN1; M2-M6--K155LA3; M7--K155LA2; M8 and M9--K155TM2; M10--K155TM7; M11--K155LA4; M12--K155LA7

Key:
1. From controlled filter
2. To level converter

The memory section is designed on the ordinary scheme of a 16-digit binary counter and serves to count the shaped pulses of the phase signals.

The programmable discriminator contains a digital comparator and interface. The reponse signal of the programmable discriminator signals that a given number of pulses of phase signals has been shaped. The 16-digit programmable discriminator is designed as a combination of two identical independently addressable eight-digit disciminators.

A specialized microcircuit with capability of regulating the level of the control signals up to 20 V is used as the level converter The time interval control module with output to the bus is designed on the basis of a pulse counter and programmable discriminator and accomplishes programmable shaping of time intervals in the range from units of microseconds to 5 10 periods of the reference frequency.

The hardware part of the programmable control device interacts with the bus controller according to the table of control instructions. The list of instructions for the case of TV control mode of the matrix with two sections (storage section and memory section) and with output register (Vykh.R) is presented in the table. The logic levels of the outputs of the phase shaper and interregister gate control module correspond in the table to: "1"--authorization of transfer ("potential hole") under the electrode and "0"--prohibition of transfer ("absence of potential hole"). The time constants in the table are given for a matrix containing 365 X 576 expansion elements (in the storage section and memory section). The format characteristics (number of lines and columns) and the related time constants should be changed for other PZS matrices. The memory capacities required to realize the programs of the most typical control modes of the PZS matrices comprise $\sim$2-4 Kbyte.

The realized version of the programmable control device permits control of matrices containing up to 10^6 elements with output signal repetition rates up to 7 MHz when using integrated circuits of series K155 and up to 11 MHz when using integrated circuits of series K531.

BIBLIOGRAPHY

1. Sequin, C. H., E. Y. Zimani, M. F. Tompsett and E. N. Fuls, "All-Solid State Camera for the 525 Line Television Format," IEEE JOURNAL OF SOLID STATE CIRCUITS, Vol SC-11, No 1, 1976.

2. Borodin, S. M. and A. K. Osipov, "Hardware-Software Debugging Complex of Limited Power," in "Teoriya i proyektirovaniye elektronnoy apparatury fizicheskogo eksperimenta" [Theory and Design of Electronic Equipment for Physical Experiment], edited by T. M. Agakhanyan, No 14, Moscow, Energoizdat, 1982.

3. Gol'dsher, A. I. et al, "Level Converter for Control of Charge Transfer in Registers Based on Charge-Coupled Devices," ELEKTRONNAYA PROMYSHLENNOST', No 7, 1982.

6521
CSO: 1863/217

NEW TECHNIQUE OF WELDING-SOLDERING MASS-APPLICATION SEMICONDUCTOR DIODES

Kiev VISNYK AKADEMIYI NAUK UKRAYINS'KOYI RSR in Ukrainian No 5, May 83 pp 96-98

[Article by UkSSR Academy of Sciences Corresponding Member V. I. Makhnenko]

[Text] There is a story to the development of this new method of welding-soldering semiconductor diodes. At the beginning of the 1960's research aimed at improving the process of assembling semiconductor devices was among important research connected with the development of control systems, which in the final analysis determine the level of many branches of industry.

An electronic equipment soldering process was beginning to be developed at this same time at the UkSSR Academy of Sciences Institute of Electric Welding. A new laboratory was established, where a new method of welding-soldering semiconductor devices was born. The initiator of this development was Oleksiy Anatoliyovych Rososhyns'kyy.

As a result of successful completion of applied research, there arose the idea of greatly simplifying and improving the operation of putting together one of the most commonly used semiconductor devices. At that time these devices were already being produced by several enterprises, in tens of millions of units per year.

An analysis of the process of manufacturing these diodes and the structure of the cost of their manufacture indicated that further improvement of the existing process did not hold promise of substantial savings: not only a fundamentally new manufacturing process was needed, but also a change in the design of the semiconductor device. Such a combined solution to the problem could be obtained only through close collaboration with those who were developing and manufacturing semiconductor devices.

The laboratory was soon reorganized into a new department at the institute, employing specialists in various fields, enthusiasts in their field of specialization: the department head, Doctor of Technical Sciences O. A. Rososhyns'kyy, and his deputy, O. H. Musin, Candidate of of Technical Sciences V. A. Lebiha, team leader welding engineer V. M. Kyslytsyn, and worker V. P. Shevchenko, who had mastered the trades of assembler, process engineer, and electrician. They comprise a combined team which is accomplishing the entire cycle of research and development, experimental design, and experimental commercial process -- jointly

with the plant which is adopting the process. Each engineer in the department has performed the functions of designer, researcher, and process engineer, depending on the project stage.

Close contact has been established with the department of semiconductors at Kiev State University. Through joint efforts by the institute, the department, and the instrument engineering production association, they have solved the problem of setting up the manufacture of diodes which are in great demand by industry. The universal application and low cost of this device as well as the high productivity of the manufacturing process have made it the largest-used semiconductor diode.

We should state that Academician B. Ye. Paton, director of the Electric Welding Institute, in spite of his extraordinarily busy work schedule, found the time directly to supervise work connected with the development of new manufacturing processes of assembling semiconductor diodes. In addition, he suggested the employment of electrical contact heating for soldering these devices. This proposal was thoroughly studied at the laboratory and ultimately became the basis for development of a fundamentally new technique of assembling diodes with a medium power rating.

The new technique of assembling this semiconductor device consists in the following: soldering of the tinned metal leads to a metallized silicon crystal with a p-n junction is accomplished by Joule heating of the semiconductor diode structure while passing electrical current across the p-n juntion. The specific feature of such "individual" heating of each device dictated the need to depart from the traditional process of group assembly of devices in hydrogen ovens.

An analysis of the cost of producing those medium power rating diodes which are in the greatest demand indicates that the new technique significantly reduces the cost of manufacturing the devices, since they involve less materials input, and use of certain short-supply materials such as silver, Kovar, nickel, and gold is totally eliminated or reduced.

The new high-productivity industrial welding-soldering process is the fruit of collective labor. O. A. Rososhyns'kyy, for example, made a large theoretical and practical contribution at all stages of the project. He proposed the principal theoretical substantiations for selection of a diode structural design, as well as welding-soldering conditions during manufacture.

The results achieved by this scientist made it possible to take a new approach to obtaining non-rectifying contacts in semiconductor devices and to specify alternatives in the manufacture of soldered-welded diodes -- with or without special thermocompensators. Investigations of rapid heating of semiconductor materials clarified the role of internal stresses which occur as a consequence of nonuniformity of heating and alternating loads, as well as their effect on the durability and electrical parameters of semiconductor crystals.

A combined method of analysis was employed to study the structure and properties of semiconductor crystals and the metal-semiconductor contact zone, a method

which includes optical and electron microscopy, X-ray spectral analysis, the method of abnormal passage of X-rays, as well as mechanical and electrical testing of soldered-welded specimens of metal-semiconductor bonds. Oleksiy Anatoliyovych is reexamining theory of cohesive strength of a single silicon crystal and is the coauthor of the majority of inventions applying to this problem.

V. A. Lebiha contributed perhaps the greatest amount at the initial stage of development of the system -- in devising a new process of assembling semiconductor devices. A combined technique of welding-soldering with employment of ultrasonic vibrations, coauthored by V. A. Lebiha, proved to be the most advanced process. Employment of ultrasound stabilized the contact resistance between the metal leads and metallized silicon crystal. It was in this period that a very high percentage of yield of usable devices was achieved for the first time -- 90%. The first U-413 laboratory units were developed with the direct participation of Vsevolod Avksentiyovych; high-output commercial semiautomatic units for performing welding-soldering operations at industrial plants, based on these laboratory units, were subsequently developed.

Exploitation of the welding-soldering process in actual production conditions is an important stage. It was necessary to study more thoroughly the phenomena and properties of semiconductors during passage of high-density current pulses in the manufacturing process. Gifted scientist O. H. Musin successfully accomplished the task, displaying outstanding organizing ability. It was at his initiative that a program of special theoretical and experimental research was conducted jointly with scientists from the university and the production association, to validate selection of diode welding-soldering conditions. This resulted in development of a method which makes it possible objectively to judge the suitability of semiconductor device heating conditions.

Team leader V. M. Kyslytsyn was the Electric Welding Institute's representative at the plant. One can scarcely exaggerate his practical contribution toward execution of the designated process engineering and experimental design program and in practical application of the welding process. Difficulties which arose in the course of the project were often surmounted thanks to Viktor Mykhaylovych's inexhaustible energy and competence.

The new soldering technique also strongly influenced the design features of the semiconductor device: the metal lead material, its thickness and width. Numerous experiments with the participation of plant specialists made it possible to find an optimal solution and to prove the viability of the proposed industrial process.

The laboratory assistants, technicians, and other workers in the department headed by O. A. Rososhyns'kyy solved a great many problems without the assistance of outside organizations, substantially shortening the time required to complete the project. Design and fabrication of experimental equipment -- the basis for designing a totally mechanized production line at the plant -- owes a great deal to the intellect and ingenuity of Vasyl' Petrovych Shevchenko.

The significance of this completed combined project to the nation's economy lies not only in increased labor productivity in the manufacture of rectifier diodes and reduced manufacturing cost thanks to a substantial savings in materials which are in very short supply. Development of a range of diodes of a new type has eliminated comparatively costly diodes with the same electrical parameters with substantial metals requirements, of considerable weight and size.

3024
CSO: 1863/213

UDC 681.32.05

BINARY IMAGE ANALYZER

Novosibirsk AVTOMETRIYA in Russian No 3, May-Jun 83 (manuscript received 10 Dec 81, final version received 16 Jul 82) pp 24-29

[Article by I. V. Belago, A. I. Pinchuk and M. A. Starkov, Novosibirsk]

[Excerpts] The direction of syntatic (language) description of images in pattern recognition problems has appeared recently. The algorithm considered below can be related by its structure to a syntatic image analysis algorithm, but the result of its operation is a table of image description which yields information for control of processing in the automatic and interactive modes.

A number of problems related to processing of some narrow classes of images can be completely resolved by using the indicated algorithm for description of coupled regions. They also include problems on processing of biological structures, tracks, and so on. However, the main designation of the algorithm should be assumed preliminary image processing by the scheme presented above, i.e., binary conversion of images and description of coupled regions.

The binarization algorithm can be modified in the following manner. We will assign a zero to the element of the binary metrics if and only if all the values of the reference set of four coincide. Thus, the connected domain of the binary matrix can be set into agreement to the contrast object of the image. The object of the image finds the identifier in the TO [object image table] in the form of the number of a column and also the parameters that permit one to judge its shape, dimensions and so on. The operator can call the object by number or feature to the display screen (the entire rectangle or the rectangle massed by the connected domain of the binary matrix), can assign a name to it, can select the program for processing it from the applied program package and can perform a number of other procedures. The following version is also possible: if the program is unable to identify the object, it is brought to the screen for identification by the operator. Thus, we find the language for interactive processing of images. Correction of the image is possible at the level of editing of the binary matrix.

6521
CSO:1863/217

UDC 621.391.2

ASYMPTOTIC RELATIVE EFFECTIVENESS OF SOME RULES OF NONCOHERENT SIGNAL DETECTION IN NOISE OF UNKNOWN LEVEL

Moscow AVTOMETRIYA in Russian No 3, May-Jun 83 (manuscript received 21 Apr 81) pp 75-77

[Article by Yu. N. Ovcharov, Leningrad]

[Text] The test, the critical region of which is independent of noise level [1], are used extensively in noncoherent detection of a nonfluctuating signal on a background of normal noise of unknown intensity. The differences in postulation, conditions and methods of solving the problem reduce to the use of different resolving rules. One of the methods of comparing them for effectiveness is calculation of the so-called coefficients of asymptotic relative effectiveness (KAOE), which are found from the following expression for algorithms that use asympototically normal statistics [1]

$$\rho_{1,2}=\left(\frac{\varepsilon_1}{\varepsilon_2}\right)^2,\quad \varepsilon_{1,2}=\lim_{n}\left\{\frac{\partial^m M\{t_{1,2}\mid q\}}{\partial q^m}\bigg|_{q=0}\bigg/\sqrt{nD_{1,2}}\right\}, \tag{1}$$

where $M\{\cdot\mid q\}$ is the mean value at condition q, $t_{1,2}$ are the resolving statistics of comparable test, q is the useful distribution parameter of the resolving statistics m is the lowest order of non-zero derivatives, $D_{1,2}$ are the deviations of the resolving statistics upon the hypothesis H_0 of the absence of a signal and n is the size of the sample.

The coefficients of asymptotic relative effectiveness of the test to be compared is equal to the maximum ratio of the size of the sample at equality of the outputs of the resolving rules and the second test is more effective than the first at $\rho_{1,2} < 1$.

A number of algorithms was compared by this principle in [2]: Prokof'yev's algorithm [3], and algorithms of simple and logarithmic contrasts. The considered algorithms correspond to a two-sample problem, i.e., to a situation when the presence of two samples--working and teaching (noise)--of identical size is suspected. Several different problems are considered in the given paper: the teaching noise sample $\{y_{ij}\}_{i=1}^{n}$ corresponds to each element x_j of the working sample $\{x_j\}_{j=1}^{N}$. As in [2], it is assumed in this case that the

elements of the sample are statistically independent and that y_{ij} is subordinate to Rayleigh distribution law, while elements x_j of the working sample either have Rayleigh distribution density (at hypothesis H_0) or Rayleigh-Rice distribution density (at hypothesis H_1 on the absence of a signal) with signal/noise ratio for output q_j.

One can show that the most powerful test invariant to noise output for the given problem has the form

$$\prod_{j=1}^{N} {}_1F_1\left(n+1, 1; q_j \frac{\lambda_j}{1+\lambda_j}\right) \geqslant C,\ \lambda_j = x_j^2 \Big/ \sum_{i=1}^{n} y_{ij}^2, \tag{2}$$

where ${}_1F_1(n, k; x)$ is a degenerate hypergeometric function [4]. It is obvious that there is no uniformly more powerful test. A locally more powerful invariant test is considered in [5]

$$\Lambda = \sum_{j=1}^{N} \lambda_j \geqslant C,\ C = \text{const}. \tag{3}$$

The statistics λ_j is subordinate to noncentral F-distribution [6]

$$f_q(x) = e^{-q} \sum_{k=0}^{\infty} \frac{q_k}{k!} \frac{\Gamma(k+1+n)}{\Gamma(k+1)\Gamma(n)} x^k \frac{1}{(1+x)^{n+k+1}} \tag{4}$$

with noncentral parameter q, taken for simplicity as identical for any values of j, which does not remove generality. Taking into account that the optimum procedure of noncoherent detection under conditions of known noise output is the rule

$$\sum_{j=1}^{\infty} x_j^2 \geqslant C, \tag{5}$$

one can easily find the expression for the coefficient of asymptotic relative effectiveness of algorithm (3) from distribution (4) by comparison to algorithm (5)

$$\rho_\Lambda = (n-2)/n < 1,\ n > 2. \tag{6}$$

It is obvious that the locally more powerful algorithm (3) is just as effective at $n \to \infty$ as the optimum algorithm for known noise output.

Table 1

n	1	2	3	4	5	6	7	∞
ρ_Λ	—	—	0,333	0,5	0,6	0,667	0,714	1,0
ρ_L	0,304	0,437	0,49	0,518	0,537	0,549	0,557	0,608

Let us consider the test based on logarithmic contrast:

$$L = \frac{1}{N}\sum_{j=1}^{N} \ln \lambda_j \geqslant C. \tag{7}$$

One can find the expressions from distribution (4) for λ_j for the mean value and variation of statistics L:

$$M\{L\} = \begin{cases} \psi(1) - \psi(n), & H_0; \\ e^{-q}\sum_{k=0}^{\infty}\frac{q^k}{k!}\,\psi(k+1) - \psi(n), & H_1; \end{cases}$$

$$D\{L\} = \begin{cases} \frac{1}{N}\left[\zeta(2) - \zeta(2, n)\right], & H_0; \\ \frac{1}{N}\left\{\zeta(2, n) + e^{-q}\sum_{k=0}^{\infty}\frac{q^k}{k!}\left[\psi^2(k+1) + \zeta(2, k+1) - \right.\right. & \\ \left.\left. - \psi(k+1)\sum_{i=0}^{\infty}\frac{q^i}{i!}\psi(i+1)\right]\right\}, & H_1 \ldots \end{cases}$$

Here $\psi(n)$ are an Euler ψ-function [4], $\zeta(k)$, $\zeta(k, n)$ are Riemann ζ-functions of first and second kind, respectively [4]. We then find from formula (1) the coefficients of asymptotic relative effectiveness of algorithm [7] compared to [5]:

$$\rho_L = 1/(\zeta(2) + \zeta(2, n)). \tag{9}$$

The values of ρ_Λ and ρ_L are presented in Table 1 as a function of n. It is obvious from the table that the effectiveness of algorithm (7) is worse than that of algorithm (3) at $n \to \infty$ by approximately 2.15 dB. However, one can note that the algorithm of logarithmic contrast is more effective than the locally more powerful algorithm at $n < 5$. This induces the idea of finding the algorithm that combines the advantages of each of these algorithms.

To do this, let us consider expression (2) once more. The following expressions are valid for a degenerate hypergeometric function [4]

$$n\,{}_1F_1(n+1, 1; x) = (x + 2n - 1)\,{}_1F_1(n, 1; x) + (1-n)\,{}_1F_1(n-1, 1; x), \qquad {}_1F_1(a, a, x) = e^x. \tag{10}$$

Using these formulas, one can find

$${}_1F_1(n+1, 1, x) = e^x \sum_{i=0}^{n} \frac{(n)_i}{(i!)^2} x^i, \tag{11}$$

where $(n)_i = n(n-1)\ldots(n-i+1)$, $0 < i \leqslant n$; $(n)_0 = 1$. At $q \sim 1/n$, which is a condition of the smallness of the signal/noise ratio,

$${}_1F_1(n+1, 1, q\lambda_j/(1+\lambda_j)) = (1 + nq\lambda_j/(1+\lambda_j)) \sim (1 + \lambda_j/(1+\lambda_j)), \tag{12}$$

and the test based on this approximation will have the form

$$\prod_{j=1}^{N} (1+\lambda_j/(1+\lambda_j)) \geqslant C. \tag{13}$$

Simplifying the resolving rule even more and using monotonic transformation, we find the following detection test:

$$\Phi = \sum_{j=1}^{N} \ln (1+\lambda_j) \geqslant C. \tag{14}$$

It is clear that the value of λ_i is "statistically" high at low value of n and the value of ln $(1 + \lambda_i)$ is similar in properties to the value of ln λ_i. The value of λ_i becomes statistically small at $n \to \infty$, so that $\ln (1+\lambda_j) \sim \lambda_j$, i.e., one can assume that algorithm (14) is close to the desired algorithm.

Table 2

n	1	2	3	4	5	6	7	∞
$\rho_{\Phi\Lambda}$	—	—	1,68	1,28	1,16	1,1	1,07	1,0
$\rho_{\Phi L}$	0,823	1,02	1,14	1,23	1,29	1,33	1,37	1,65

Using expresion (4) and the tabular integrals of [4], one can find

$$\begin{gathered} M\{\ln (1+\lambda_j)\} = e^{-q} \sum_{k=0}^{\infty} \frac{q^k}{k!} [\psi (k+n+1) - \psi (n)], \\ D\{\ln (1+\lambda_j)\}_{H_0} = 1/n^2. \end{gathered} \tag{15}$$

Then, according to expression (1), the coefficient of the asymptotic relative effectiveness of algorithm (14), compared to algorithm (5), has the value

$$\rho_{\Phi} = n^2/(n+1)^2. \tag{16}$$

At $n \to \infty$, $\rho_\Phi \to 1$, i.e., test (14) is just as effective as the optimum algorithm for the known noise output. By comparing (14) and rules (3) and (7), we find

$$\rho_{\Phi,\Lambda} = n^3/(n-2)(n+1)^2,\ n > 2;\quad \rho_{\Phi,L} = n^2\ [\zeta (2) + \zeta\ (2, n)]/(n+1)^2. \tag{17}$$

These values are presented in Table 2 as a function of n. It is obvious from the table that test (14) is more effective than the logarithmic contrast and locally most powerful algorithms, although one assumes a somewhat more complex realization. Thus, the derived procedure is close to the rule, the requirements on which were formulated earlier.

The given consideration showed that the logarithmic contrast algorithm, losing out to the locally more powerful algorithm at large value of n, has greater

effectiveness at small sizes of the teaching samples. This makes its use preferable compared to the locally more powerful algorithm in detection of signals under conditions of fast variation of noise intensity.

The derived procedure (14) has greater effectiveness compared to both the rules mentioned above. Therefore, preference should be given to this algorithm when the concepts of hardware realization are not of predominant significance.

BIBLIOGRAPHY

1. Levin, B. R., "Teoreticheskiye osnovy statisticheskoy radiotekhniki" Theoretical Fundamentals of Statistical Radio Engineering], Book 3, Moscow, Izdatel'stvo "Sovetskoye radio", 1976.

2. Nikitin, Ya. Yu., R. P. Filimonov and Ye. P. Shubina, "Calculation of Asymptotic Relative Effectiveness of Some Invariant Detection Rules in Two-Channel Processing Systems," AVTOMETRIYA, No 2, 1978.

3. Prokof'yev, V. N., "The Invariant Rule of Noncoherent Signal Detection on Noise Background of Unknown Level," RADIOTEKHNIKA I ELEKTRONIKA, Vol 18, No 3, 1973.

4. Gradshteyn, I. S. and I. M. Ryzhik, "Tablitsy integralov, summ, ryadov i proizvedeniy" [Tables of Integrals, Sums, Series and Products], Moscow, Izdatel'stvo "Nauka", 1971.

5. Vasil'yev, K. K., "Digital Detection of Noncoherent Pulsed Signals at Variable Noise Output," IZVESTIYA VYSSHYKH UCHEBNIK ZAVEDENIY. SERIYA RADIOELEKTRONIKA, Vol 21, No 7, 1978.

6. Leman, E., "Proverka statisticheskikh gipotez" [Verification of Statistical Hypotheses], Moscow, Izdatel'stvo "Nauka", 1979.

6521
CSO: 1863/217

REPRESENTING DESIGN INFORMATION IN AUTOMATED SYSTEMS

Moscow NA STROYKAKH ROSSII in Russian No 6, Jun 83 pp 46-49

[Article by O. Musayev, senior scientific associate of the department of design automation of TsNIIproyekt, "Representing Design Information in Automated Systems"]

[Excerpts] The total volume of design work breaks down into the following parts: technical and economic calculations, 10%; development of design solutions, 20%; formulation of design estimate documentation (PSD), meaning blueprint and graph work, 50%; coordination of design solutions, information search and other preparatory work, 10%; and cost estimates, 10%.

A major reserve for reducing PSD output times is automation of blueprint and graph work, search for the required design information and coordination of project solutions. Automating such design activity will make it possible to attain the specified level of design automation in the 11th Five-Year Plan of 15-20%.

It should also be noted that in the technological preparation for construction work to choose necessary information from projects and process it is quite labor consuming (at least 8500 man-days, to 12-15,000 pages of estimate documentation and up to 18,000 pages of working drawings for an average general construction trust). Automating document execution for the technological preparation of construction work enables a major reduction in the labor input of PSD processing.

The conventional methods of representing PSD's for construction projects are graphic and text documents.

With the intensive development of automated design, the problem of a major expansion of the forms of design information representation for conventional and new automated techniques of construction design has arisen and gained in importance.

The basic direction in solving this problem is to develop methods of numerical modelling of capital construction projects to considerably expand the range of automated processing of design information, and attain the best relation between the new technology for producing design documents and the conventional one of their use.

The efficiency of using automated systems in the national economy is thus directly dependent on solving the problem of numerical modelling of capital construction projects.

Scientific and practical development of methods of formalized description of construction projects is being handled by TsNIIproyekt, TsNIIPSK, KiyevZNIIEP, NIIASS, Khar'kovskiy PSP, NIIOUS at MISI imeni V.V. Kuybyshev, MNIITEP and other organizations.

The construction project is represented in a numerical form, representing an organized data set constructed in strict accordance with a set of specific rules. The numerical model is formally defined as a certain structure (matrix) representing the set of properties of the construction site, whose elements can have fixed semantic and random numerical values.

The range of use of numerical models of construction projects is integration of the components of SAPR [automated design system] and ASTPP [automated systems for technological preparation of production] software. Numerical models of the construction projects should be viewed as a standard component of automated system software.

The efficiency of the method developed for numerical modelling and the program system of the TsMO [numerical model of the project] has been checked in solving problems such as automated output of blueprints in an SAPR; and conversational interaction of users with the numerical model of the project.

The results of the work have been introduced into "TLP-PROMZDANIYa", developed according to the work program of the USSR State Committee for Science and Technology in 1976-1980 in solving task 04.80 "To Create and Put Into Experimental Operation at Goskhimproyekt and Leningradskiy Promstroyproyekt Automated Design Production Lines (TLP) of the Construction Portion of Industrial Buildings", for automated coordination and production of construction blueprints.

The economic effect from introduction in the problem of automated production of a set of blueprints is a reduction in labor costs of 756 man-hours, and in work cost of 924 rubles.

Economic efficiency has been gained from introducing the numerical model and program system of the TsMO in the automated control system of the Leningrad production construction association (ASU-LPSMO) of Glavzapstroy of USSR Minstroy for the problem of automated formation of maintenance requirement cards for construction of the galvanic plant in the amount of 15,300 rubles.

The economic efficiency from using methodological materials on the use of a numerical model of the project and program system of the TsMO in design institutes such as GPI construction machine building (Bryansk) and GosNIIsredazpromzernoproyekt of the USSR Ministry of State Purchases (Alma Ata) is 13,000 and 11,500 rubles, respectively.

9875
CSO: 1863/206

COMPUTERIZED PROCESSING OF TRANSPORT DOCUMENTATION

Moscow NA STROYKAKH ROSSII in Russian No 6, Jun 83 p 49

[Unsigned article,"Computerized Processing of Transport Documentation", in the column "Introduce Them at Your Projects"]

[Text] An automated system for processing new forms of transportation and commercial transport documentation (TTD) was introduced at the vehicle transport office of Glavmurmanskstroy in 1980.

The complex of programs was developed by the Main Computer Center of the KaSSR Minavtotrans. The program was implemented on the YeS-1022 computer by the multiple-user computing and data processing center of Glavmurmanskstroy. The on-line production of information makes it possible to know the results of the operation of the enterprise as a whole and its subdivisions to the crew level, and of each driver, within a day.

The drivers' trip tickets, received daily from motor transport firms, are processed to obtain:

calculation of the hourly and piece-work income of drivers, with allowance for bonuses;

accounting for fuel consumption;

delivery of bills to customers;

accounting for income by subdivisions, crews and drivers;

calculation of operating performance for vehicle types;

recording of runs by garage numbers, vehicle types and types of hauls; and

accounting by cargo types.

Introduction of the automated system of TTD processing has allowed an increase in the volume of incoming information, a major reduction in its calculation time, and a rise in quality and reliability. The information obtained enables on-going, comprehensive evaluation of the enterprise's operations. It also reveals

the causes of nonfulfillment of plans by drivers, crews and subdivisions, and enables specific decisions to be made to improve the production process and enhance the quality of management and coordination of socialist competition. Daily analysis of reports enables drivers to keep track of their work and compare it with the results of others, and raise their labor productivity.

Computerized processing of this type of documentation and acquisition of more information are equivalent to freeing 8-10 people in accounting.

The annual economic effect from introducing automated processing of transportation and commercial transport documentation is 68,000 rubles.

Information on the introduction can be obtained from: 183045, Murmansk, 45, prospekt Kol'skiy, 51, ATK Glavmurmanskstroy.

The address of the Main Information Computer Center of Minavtotrans of the KaSSR: 480072, Alma-Ata, 72, prospekt Abaya, 42/44.

9875
CSO: 1863/206

AUTOMATED DESIGN SYSTEM CENTER DISCUSSED

Leningrad LENINGRADSKAYA PRAVDA in Russian 22 Jun 83 p 2

[Article "In Mirror of an Experiment" by V. Aleksandrov, director of Experimental Collective Use Center of the "Lenpromstroyproyekt" Institute]

[Text] What designer had not felt disappointment because he did not succeed in embodying a fleeting thought about a solution in a sketch? And yet this can be done quite realistically by computer technique. Because of it, that fleeting thought can be recorded almost instantaneously and then checked, evaluated and corrected.

Of course it is not a matter only of the speed. Automation of working positions of designers makes it possible to have a sharp increase in the productivity of labor of specialists, in improving the quality of their work, reducing the laboriousness and reducing the time needed for design.

Regrettably, these questions remain in a shadow. It is sufficient to say that, on the average, only 3 to 5 percent of the total volume of design documentation is prepared in Leningrad design organizations which use computer techniques. In fact, more than two years have already passed since the issuance of the decree of the CPSU Central Committee and the USSR Council of Ministers "On measures for further improvement of design and estimating," that posed a concrete problem -- by the end of the five-year plan period, increase the automation level to 15-20 percent of the total volume of design.

It is not said in vain that halfway is a good start. The situation is such that if automation of the production process usually begins with an entirely new organizational-technological production structure, then, in the sphere of design, say, of capital construction, an attempt is usually made to embrace traditional methods of calculations by automation. In fact, their basis is well known -- many years of experience, including, in many respects, the outdated use of the slide rule and the adding machine. Therefore, the introduction of an automated design system (SAPR) can have a palpable effect only if, from the very start, it is based on a sober analysis of the possibilities of one or another organization.

Not to speak idly, I will cite the experience of the "Promstroyproyekt" Institute. Here already in the 10th Five-Year Plan period, they have begun to

create SAPR for such industrial facilities as buildings and structures for ferrous and nonferrous metallurgy and for the cellulose-paper industry. Everything began with a thorough analysis of all sides of the collective's activity, primarily of the entire technical standard of labor organization. In fact, the use of automation in design is unthinkable without the clear-cut regulation of the entire path of the project -- from the general concept to detailing the multiplicity of components.

Then dozens of programs were developed and introduced to solve architectural-construction and sanitary-technical problems in issuing estimate documentation. Of course, there were also problems of preparing specialists: designers were trained to carry on a dialogue with the computer at the automated working position and in a short time they were instructed to analyze several versions of design solutions. In the last five years, the introduction of only the first stage of the SAPR made it possible for the institute to provide an increase of two percent in the work volume at the same time reducing the number of designers by 13 percent.

Here, in my opinion, it is relevant to mention another important circumstance. By freeing the designers from laborious routine operations by means of the SAPR they can spend more time on purely creative searches for solutions. Of course, new functions are now being placed in the hands of specialists: preparation of data, analysis of results, monitoring originating situations and operational corrections. Thereby the designers acquire new experiences which make it possible to execute the constantly increasing volume of work with better quality.

As we see, the wide use of computer techniques in design opens up large additional reserves for increasing the efficiency of labor. The advantages are obvious, nevertheless, the general level of automation in design institutes in the city is not high so far.

We should not disregard, of course, a certain scarcity of special equipment. But even the available equipment is far from being used fully. We can cite many examples where expensive equipment stands idle due to the lack of specialists to operate and service it, or the lack of proper buildings for placing the equipment etc. We think that these questions as well as utilization coefficients of already available equipment must be taken into serious consideration when providing equipment to design organizations. Here several words need to be said to ASU [Automatic Control System] rayon sections of economic and social development councils.

As in any new business, the introduction of the SAPR in practice of the design organizations would be more successful if the accumulated experience were better utilized. In its time, when the "Promstroyproyekt" introduced the first stage of the SAPR, many organizations turned to it for consultations and requests. It may be said that at that time the idea was born of utilizing electronic computer means not only for their own needs, but also to provide them to other design-research organizations in the city. Practice showed the utility of such an approach: the utilization coefficient of the scarce equipment increased.

In this connection, the following step -- the creation at the "Lenpromstroyproyekt" of an experimental collective use computer center is natural. It was charged with executing work on the computer for design organizations on a united technical, program, data and informational and organizational basis.

The appearance of such a center creates premises not only for further centralization of material and labor resources in servicing the design-research organizations by automation facilities. It is a sort of prototype for collective use design-computer centers and it checks numerous parameters and requirements which must be met by such collectives 5 to 10 years hence.

During the short time that the center has existed, many are already convinced of its usefulness. But we are also convinced of another thing. The collective use of SAPR facilities made more acute the problem of supplying tne center with materials and spare parts,for example, lavsan inking tape for printers, magnetic tape and small cassettes for it, recording pens and inks for graph plotters. The Leningrad procurement organizations, especially the Lenlesbumsnabsbyt and the Lenmashsnabbyt, can provide more efficient help here.

On the other hand, in Leningrad today, there is a very acute problem of preparing cadres to work under new conditions. Immediately after the creation of the collective use center, it received many inquiries from design-research organizations with requests for help in assimilating and using the means of automation. It is characteristic that the prevailing majority of requests were reduced to one -- train staff members to operate the new equipment. Yet there is experience in the city of such training in ASU within the framework of the "Lenelektromash" NPO [Scientific Production Association]. Apparently, it is also advisable to expand the activity of this institute in the direction of training skilled cadres along the "SAPR in construction" specialty.

2291
CSO: 1863/211

USE OF COMPUTERS IN DESIGN OF HOUSING

Moscow STROITEL'NAYA GAZETA in Russian 27 Jul 83 p 3

[Article "Electronics Presents Bill" by O. Rybinskiy, manager of the Department of Mathematical Design Methods of LenZNIIEP [Leningrad Zonal Scientific Research and Design Institute of Typical and Experimental Design], candidate of technical sciences; I. Dvorkin, sector manager, candidate of technical sciences; V. Kuntsman, architect]

[Text] For many years, computers have been used in the LenZNIIEP to calculate components of static and dynamic structures, as well as to solve heat engineering, financial, economic and other problems. The volume of design done by using electronics in 1981 reached three percent. By the end of the five-year plan period, and increase in this indicator to 20 percent is contemplated.

Last year the institute did a large amount of investigation and developed a technical project for introducing the first stage of a design computer center for the institute. To a considerable extent, developments of the Kiev ZNIIEP -- the leading institute on the SAPR [System of Automated Design] problems -- were used in this case.

Of course, the development of a unified system for automating design in Gosgrazhdanstroy institutes determines the set of basic technical facilities, the interaction of components and the list of programs. This protects against errors characteristic of the period of search. But each of the zonal institutes must orient itself to form its own data base, as well as to correct the program, technical and organizational software in correspondence with the specifics of the projects and its own organizational structure. And here, the institutes tread an unbeaten path.

It is planned to divide the first stage of the PVTs [Design Computer Center] of LenZNIIEP into two subsystems. The first will be assigned to automating design at the TEO [Technical Economic Substantiation] stage, to process project proposals, their analysis and optimization of solutions. The second -- to automate the working project proper, issuing structural drawings, equipment, engineering systems and estimates.

The first subsystem is oriented toward typical projects. It forms a technological design line (TLP) of volumes and plans of large panel housings. This is an entirely new program complex that requires the direct participation of architects in working with computers. Such contact will occur in the dialogue mode: the architect composes the plan and the facade while the machine draws a sketch, makes the necessary calculations and provides the evaluation of the version. The optimal version will be drawn fully and will be ready for design. The following will be obtained at the computer output: drawings and semifinished products of plans, facades, installation arragements, lists of products at the design stage, and tables of all necessary indicators. The interest of architects in the TLP is also determined by the possibility of the rapid plotting of promising images of the object.

According to Gosekspertiza data, the economic effect of choosing optimal solutions at the earliest stage (from the search for economy and correction of initial errors) may amount to a billion rubles in the estimated cost to the country as a whole. The computer, however, will make it possible, by all around "repumping" of a great number of project proposals, to find the most efficient solution rapidly. It is also important that the project proposals remain in the computer memory. They will serve as a basis for forming a data base for the project solution of fully prefabricated buildings which, in the practice of the LenZNIIEP -- are typical housing for the North.

The second PVTs system includes two components: a terminal complex for an automated working position for the designer (TK ARMP) and applied program packets (PPP). Both are designed for automated output to an amount of 27,000 rubles of working drawings for frames, walls, roofs, foundations, industrial products, their catalogs, and selection of materials.

The expected benefits from creating the first stage in 1984 are 326,000 rubles per year and a labor productivity increase of 24 percent. The designers will be freed to a considerable extent from monotonous tiring work which will simultaneously activate the creative process itself. There is no doubt that the projects will be of higher quality.

At the same time, in the design and rapid introduction in operation of the first PVTs stage, there are many difficulties and the solutions of an entire number of problems, that are already originating, will be required. In fact, the introduction and development of the new technology of design is being implemented under conditions of labor forms which have been put together for a long time. Their replacement by new ones should not affect the continuity and rate of product output.

The creation of the PVTs using computers widely involves the development of new organizational forms. Efforts of various specialists such as scientific workers, architects, design engineers, estimators who use computers for everyday work should be united in one continuous process. The situation is complicated by the acute shortage of skilled specialists in automated design and the lack of experience in creating SAPR systems.

It is very complex (and we are convinced of that every day) to overcome psychological difficulties. They are related to the necessity of the fairly rapid reorientation of designers to entirely new forms and methods of work. Under traditional conditions, sanctified by decades of design approaches and under conditions of built-up stereotypes of professional hierarchy, it is not simple to solve this problem, especially on compressed schedules.

But the main difficulties for the LenZNIIEP are related to the specifics of the typical design for the North which make up about a quarter of the volume of design work by the institute. Because of the multiplicity of repetition of typical building designs there is a multifold multiplication of the economic and qualitative achievements, as well as of shortcomings of each typical design. The responsibility of designers increases sharply. On the other hand, a typical design contains a huge amount of monotonous routine work. All this determines the basic thrust in introducing automation primarily in a typical multiversion design. By the way, it lends itself to formalization considerably easier than individual designs.

But typical designs for the North have a number of special features. Homebuilding combines here are isolated, frequently low capacity, and the work, under inclement climatic conditions, is difficult. The assortment of construction materials is limited and transportation facilities are undeveloped. It is understandable that the spectrum of typical solutions must be very wide and the versions must be numerous.

And it is not only the diversity of initial data that determines the specifics of typical northern designs. In many regions, construction conditions are very atypical. There is no experience in mass construction and there are no rigid norms for designs for these regions. Since typical designs are issued for all regions of the North, the majority of them are unavoidably of an experimental nature in the initial period.

All these special features of a typical design for the North determine the specifics of difficulties in its automation. Correction of programs and a method for automated design must be done by taking into account the great diversity, but with limited experience in typical design and with unfinished norms for it. There is another contradiction difficult to resolve -- the data base of the system must contain averaged indicators for the designs, design characteristics, products etc. But how to average, if the typical designs for many versions of initial products exist in one single model so far?

With this situation, the PVTs introduction must be combined with doing a number of investigations, working on scientific developments and correlations. It appears to us that most of the problems we are speaking about in this article are characteristic for many design institutes that introduce or are getting ready to introduce the SAPR. The concentration of attention on all originating problems, their effective considerabion and constant exchange of experience must help the important matter of raising the efficiency of design and, in the final account, the progress of capital construction as a whole.

2291
CSO: 1863/211

AUTOMATED INDUSTRIAL CONTRACTING SYSTEM DESCRIBED

Moscow KHOZYAYSTVO I PRAVO in Russian No 6, Jun 83 pp 28-29

[Article by D. Rayev, chief of the legal bureau of the Volgograd production association for tractor parts and standards: "In the Framework of an Automated System"]

[Text] Almost all the work involved in signing industrial contracts and monitoring their fulfillment in the Volgograd production association for tractor parts and standards has been automated.

The computerized data center set up 10 years ago was based on the YeS-1022 computer, which is capable of performing 80,000 operations per second. After its installation preparations began for the introduction of an automated enterprise management system, one component of which was automation of the work involved in signing industrial contracts and monitoring their fulfillment.

Because of delays in signing many contracts and the vast amount of work involved in timely monitoring the fulfillment of contractual commitments for shipments of 2,000 different items, this was a task of great urgency.

The engineers, technicians, programers, operators and lawyers of the association pooled their efforts in developing the initial documentation and building up the data and reference files.

In 1976, all potential buyers were sent a standard form of contract request specifications and a protocol of differences. Now all they have to do is fill in the names of the required items and the quantity requested over the year.

Upon receiving the request specifications they are checked by workers of the production supervision department's orders office, who write in the code names of the items and pass the document on to the data computer center. The computer immediately feeds out all the documents needed to sign the delivery contract. They include a detailed contractual specification, indicating the quantity, price, total sum and delivery deadlines of every item; a master list according to categories of items by quantity and cost; a master list of metals requirements specified according to type for both the customer (for transfer of funds) and the association's materials and technical supplies department; estimates of requirements of other materials; information on rate of consump-

tion of materials. After that the draft contract forms are filled out, signed and sent to the customer.

Information about any changes in the contract made during negotiations and of its fulfillment is immediately transmitted to the computer center, which feeds back revised versions of the aforementioned documents. True, the contractual specifications are not usually revised completely, but only those items in which changes were made. At the same time, the new overall cost of the contract is computed and indicated.

It is obvious that the computer has assumed a vast amount of the contractual work, helping to save the effort and time of many experts during contract negotiations. We should note that along with outputing contractual specifications for each customer the computer builds up data files, keeps track of orders, and computes production plans and shipments of finished products.

The association does not have an assembly shop. Fasteners, springs, tools and other items are delivered directly to the warehouse for shipment to customers. According to the contracts, the computer issues assignments to every shop for the manufacture of specific items, indicating the customers, delivery deadlines, and total cost. As a result the shops are able to immediately crate and identify their products for delivery to each customer.

Now products can be shipped to customers straight from the shops (with the invoices handled by the warehouse). This has made for savings of time and money.

How is the fulfillment of contracts monitored?

All the invoices for items shipped to customers are immediately forwarded to the data computer center, which stores the information on the fulfillment of production plans for each item in all contract specifications.

Thus, the computer's memory contains data on production plans, plans of delivery of items to individual customers, the total volume and cost of fulfilled production plans and sales from the beginning of the year, quarter and month, as well as data on underfulfillment or overfulfillment of plans during the same periods.

This information can be recalled on request in whole or in part on punched cards or video display terminals installed in the offices of the general director, the production director, and the marketing department. Altogether up to 40 document forms can be presented.

The computer also monitors the fulfillment of contractual commitments in respect of range of products.

Ten and three days before the end of a contract it issues a "warning" to the personnel responsible for it, and subsequently what could be called a contract fulfillment factor.

Only three primary documents are needed to get all this data: the contract specification, invoice of items delivered to the warehouse, and the shipment report.

Some of the claims and litigation work is also mechanized at the association, notably the analytical work. The automated enterprise management system also handles the problem "Computation of Indicators Required for Claims and Litigation." The computer performs, among others, the following functions: it keeps records and subject files of claims regarding the quality of goods produced by the association (by shops, items and contracting parties), records of claims satisfied or rejected, and quarterly records of claims and actions filed by the association and subcontractors (classified by type and other indicators); and it estimates time actually spent considering claims received (classifying them according to types).

The system of keeping records of all claims and litigation makes it possible to readily analyze the causes of deviations in the quality of products and failure to meet delivery commitments, and to take timely measures to rectify these shortcomings. A thorough computerized analysis of the results of action taken on claims and litigation is carried out every quarter and at the end of the year.

Information received on how subcontractors meet their commitments also makes it possible to discover the causes of violations of contractual commitments and take urgent measures to prevent disruptions.

We attach special importance to analyzing claims and litigation regarding the quality of the association's line of products. The computer monitors every output item, all the shops, as well as the customers submitting claims and suits. The purpose of this is to improve the quality of the association's products.

It should be noted that, along with keeping records of claims and litigation against us and by us, the computer is used to analyze the quality of the work on claims and litigation by each employee of the legal department.

Obviously, the potentialities of the computer have been far from exhausted. On the order of the day is the task of organizing record-keeping on raw materials received, supplies, payment of fines, and losses not covered by forfeiture.

9681
CSO: 1863/197

AUTOMATED SYSTEM FOR HOUSING AND MUNICIPAL SERVICES MANAGEMENT

Minsk SOVETSKAYA BELORUSSIYA in Russian 9 Apr 83 p 2

[Article by L. Anisovets in "Facts and Commentaries" column: "'Intellekt' Advises, Analyses, Recommends and... Reminds"

[Text] /One evening the telephone rang in a Minsk apartment. There was certainly nothing extraordinary in that, but after the head of the household's customary response it became unusual indeed, because the voice in the receiver was obviously not human, although the subject was mundane enough. The mysterious speaker informed the tenant that he owed his rent and utility bills and reminded him of the need to pay them. This was done the following day, but the inhabitants of the apartment continued for a long time to wonder who had tracked down their default.

It was all cleared up when the tenants learned that starting on 1 October 1982 the "Intellekt" operational management system had begun phoning all defaulting tenants. The results of this experiment surpassed all expectations: within a short period of time the number of defaulters in the monitored city district dropped by 60 percent. What was this innovation?/ [in boldface]

The "Intellekt" operational control system set up within the framework of the branch automatic control system came into being as a result of the creative collaboration of associates of the Special Technological Design Bureau for Control Systems of the Belorussian SSR Ministry of Housing and Municipal Services and the Minsk Scientific Department of the Communications Scientific Research Institute. It was designed on the basis of the YeS-1022 computer and includes a unit for receiving information along communication channels directly into its memory, a voice synthesizer interface, and a connector with the municipal telephone system.

Communication with tenants is but a minor element in the capabilities of the "Intellekt" system. Its main task is to help top-echelon executives to run the branch efficiently and solve complex economic problems. For this the system automatically stores in the computer memory and monitors reports from all parts of the republic. It carries out an economic analysis of the initial information and issues forecasts and recommendations. It can be accessed by telephone and responds appropriately and in a readily comprehensible form. It monitors action taken on statements, requests, and documents the deadlines for which are

approaching. The computer memory is loaded with 300 problems, 36 of them vocal, the others transmitted via a display. To solve all these problems it must processes some 50 million units of information.

The "Intellekt" system implements an approach to the creation of a "paper-free" managerial technique. The science of artificial intelligence has been developing for many years in our country and abroad. It seeks to make use of computers to simulate intelligent human activity. Scientists are working on devices designed to enhance man's intellectual potential and take over part of his mental effort. Computers do not always handle this task well. Firstly, there are quite a few intermediaries between the controlled entity and the supervisor (operators, economists, and others)--an average of fifteen to every computer. And there are more than 700 computers in the republic. The "Intellekt" system, however, provides for data acquisition directly in the computer's memory and for direct contact between the supervisor and the computer. Furthermore, on the scale of the republic there is the problem of delivering processed material to the supervisor. This computer shortcoming is in part reduced by using a display, but its range is very small--not more than 700 meters, while devices for communication over longer distances are quite expensive. When hooked into the telephone network the "Intellekt" system can receive information form, and transmit it to, any place in the country.

The simplest decisions and minor data are printed out on paper. Answers to problems requiring more detailed analysis and extensive generalization are transmitted via the display. The most complex economic and managerial analyses, long-term forecasts and practical recommendations are given via voice output. Voice problems cover a wide range of questions describing the economic conditions in the branch for the republic as a whole, by oblasts, according to the principal forms of activity, capacities, by year, quarter, and month. The information the machine is capable of outputing in response to coded queries to supervisors of the rank of minister and his deputies is sufficient for making a quick decision without having to seek additional data on the display. The dialog with the computer takes a few minutes, there is no paperwork involved, while the system scans enough data to fill 15 or 20 books of 20 signatures each. The system's "intellectual capacity" is 5,000 rubles per hour, while the cost of one hour of machine time is 85 rubles.

Thus, the economic and social advantages of the "Intellekt" control system are obvious. What are the prospects of its application?

Within the coming years it is planned to automate water management in the oblasts. At present it is not possible to set up a computer in every oblast center. The "Intellekt" system offers another solution. For example, in Vitebsk there are four pumping stations and three central dispatcher stations. All that is needed is to set up teleprinters to transmit information about the technological process to the computer in Minsk. It will analyze the data, develop the optimal operational conditions and transmit them to the pumping stations, while the central dispatcher station will communicate the instructions by telephone.

Work has now begun on a series of models for evaluating economic situations. They will enable supervisors of all levels to take part in preplanning and planning estimates.

There are also some purely technical aspects that have to be worked on. At present data is inputed in the computer via a display. This is a rather complex operation requiring supervisors to have the capabilities of a skilled operator. Again, an important aspect is the distance of the utility from the computer center. That is why the problem of voice input of commands is being tackled. The experts are also working on teaching the machine to perceive a number as a whole (at present instead of the number 123 it is necessary to sequentially input the numbers 1, 2, 3).

Like every innovation, the "Intellekt" operational management system will be gradually upgraded in operation. But already now executives of the republics housing and municipal services have obtained a reliable adviser and helper in questions of operational management of the branch. The Belorussian SSR Ministry of Communications is also introducing some elements of the system. Dissemination of the experience accumulated by the "Intellekt" system will help enhance the efficiency of production and quality of management.

9681
CSO: 1863/197

MAN-MACHINE INTERACTION SIMPLIFIED

Alma-Ata AVTOMOBIL'NYY TRANSPORT KAZAKHSTANA in Russian No 6, Jun 83 pp 20-21

[Article by Yu. Dolzhanskiy, chief of department of Main Information and Computing Center, KaSSR Ministry of Automobile Transportation]

[Text] Third-generation computers with their high speed, large memory, direct-access devices and terminal systems offer the capability of developing and introducing real-time automated information processing and communication systems. These systems can be used for various functions: information inquiry, source data acquisition and processing, message switching, process control and others. They enable considerable improvement in process monitoring or control operations.

Real-time systems differ from batch processing systems now in operation by the fact that they allow data input directly from terminals and receiving the data processing results on a display screen with a minimal wait.

Especially relevant to automobile transportation is the system for entering and checking data from trip and commodity transportation documents.

For the first time in the country, such a system was developed and introduced in the Main Computing Center for the republic's Ministry of Automobile Transportation using the Unified System OS, the YeS-1060 computer, the YeS-7920 terminal system and software written by center specialists.

The YeS-7920 is a new family of information displays offering alphanumeric information display, editing, printing and storage of edited data. This allows processing trip and commodity transportation documents in the interactive mode. Up to 32 displays can be connected to one YeS-7920 system. Screens can display 24 lines of 80 characters each.

A software package was written and debugged to develop software for entry and checking of trip and commodity transportation documents in real time by using the YeS-7920 system. This package required fundamentally new methods of programming differing considerably from those used in batch processing. Implementing these methods caused an increase in complexity and volume of work for the programmers. Suffice it to say that the package has 17,000 statements.

Much attention was paid to operating reliability when the system was developed. During the computing processs, the system keeps information on its current status on magnetic disk. This allows recovery to restore system operating conditions closest to those in effect before a malfunction.

The terminal system enables entering data into a computer without intermediate media (perforated tape) and checking data on the screen without having to print it (saves paper).

It is also important to note that only part of computer capacity is needed for system operation (within 20 percent of CPU operating time). For maximum utilization of computer capabilities, the machine is operated in the multiprogram mode; several other jobs can be running while the data preparation and checking system is operating.

The interactive mode allows operators to make on-line corrections to errors made in perforation and completion of the documents which are automatically displayed.

Documents are checked in three stages. Each stage allows correction of errors. The first stage is format checking. In this stage, the document to be input is checked (trip list, commodity transportation invoice, certificate of measurement) for format by the number of essential elements and sequence of their arrangement. In the second stage, data from commodity transportation documents are linked and collated with the trip list. Logic is checked in the third stage: trip document indicators are cross checked against 264 parameters by using 19 sets of standards and reference information. Information displayed on the screen for correction of errors detected by the operator is: logical error number, trip list number, commodity transportation invoice number, numbers and values of all essential elements used in checking for a given error. Information from a checked trip list is stored on magnetic disk and the operator is sent a message to switch to perforation of the next trip list.

When it cannot be immediately corrected, a trip list can be stored in a data set on magnetic disk and recalled later for checking.

Under the old data perforation technology, errors were discovered only on the next day after data entry and processing on a computer by printing out all errors. This required additional labor, machine time and paper. In addition to the consumption of these resources, the data processing cycle was extended. Now, with the new technology, we have reduced to the minimum carry-overs of trip lists in which errors are found in their completion and perforation as a result of machine logic checking. Because of time overlap for data entry, checking and error correction, document turnover time has been reduced threefold. As a result, interaccounting is speeded up, and validity of operational information is enhanced through more complete accounting of data from documents which come into the Main Computer Center. In the end, all this has a positive impact on the standard of operational management of the industry.

Another major advantage of the real-time system is that it allows considerable improvement in operator working conditions. When the STA [start-stop telegraph apparatus] telegraph apparatus was used for perforation, there was continuous noise caused by operation of them in the data preparation room; the air in the office was filled with paper dust; workstations were cluttered with hundreds of meters of perforated tape. This is all history now.

Combining operating and checking functions in one person lends a creative nature to the data preparation process. Training and enhancing skills of operating personnel is effected considerably faster because of the clarity of the entry and checking processes. With the new technology for processing input information, excepting the nonproductive inputs of time for preparatory and auxiliary operations, machine time is also reduced. Because of the significant increase in perforation speed and combining the functions of data preparation and checking for errors in document completion, labor productivity has about doubled for these employees.

The real-time system, as communication circuits evolve and improve, will allow preparing source information directly at the automobile enterprises and processing it at major multiuser computer centers.

8545
CSO: 1863/189

EFFICIENCY AND DEVELOPMENT PROBLEMS OF AUTOMATED CONTROL SYSTEMS DISCUSSED

Alma-Ata NARODNOYE KHOZYAYSTVO KAZAKHSTANA in Russian No 6, Jun 83 pp 62-65

[Article by Candidate of Economic Sciences M. Shcherbak, "ASU: Efficiency, Development Problems"]

[Text] Ten years have passed since automated construction control systems (ASUS) were created at the republic's construction organizations and construction industry firms. At the beginning of the 1970's, republic information computer centers (RIVTs) were organized for several construction ministries, equipped with high-speed computers, as well as organizations designing the ASU projects. These included the Kazakh division of the NIIsistem USSR Minpribor, State Planning Institute Proyektmontazhavtomatika USSR Minmontazhspetsstroy, and planning and design bureau type subdivisions of ASUstroy of the KaSSR Mintyazhstroy. Departments and bureaus are being created in construction and assembly trusts, housing construction associations and headquarters to create and operate the systems.

Network graphs were intiially mastered and applied at construction sites. First, to manage construction of large complexes; later, to plan and manage the annual production program of trusts, housing construction associations and industrial firms. At the same time, they began to be used as the basis for econometric models of ASU's.

Use of the network graphs was aided by the possibility of using them to define the so-called critical path, or the greatest bottleneck in construction work, and organizing effective control of the course of construction processes by deviations. Addition of economic characteristics (physical amounts, intensity of work, cost, labor productivity and others) to the "network" fundamentally altered the nature of the network graph. The result was the transition from a simple analysis to the process of generating valid management solutions. Unfortunately, the possibilities inherent in the systems of automated construction control have yet to be realized, and the situation in this area today remains about the same.

The total sum for acquiring computer equipment, developing ASUS projects and introducing them was over 20 million rubles for the ten-year period. 27 computers are in operation (14 of the YeS computer class). Most of them (13) are concentrated in the republic computer centers in Alma-Ata. The remainder are in peripheral branches: Karaganda, 4; Dzhambul, 3; Chimkent, 2; Kustanae, Pavlodar, Ust'-Kamenogorsk, Ural'sk and Tselinograd, one each. Over 100 specialists are involved in project development and system introduction and operation.

Five ministries (Mintyazhstroy, Minavtodor, Minmontazhspetsstroy, Minsel'stroy and Minvodkhoz of the KaSSR) and two republic main administrations (Glavalmaatastroy, Glavrissovkhozstroy), performing two-thirds of the contract work, use over 500 tasks of varying levels and purpose, according to report data. Of these, 118 tasks were developed for housing construction associations; 117, for main administrations; over 70, for trusts; and almost 50, for construction firms. Design institutes of KaSSR Gosstroy use 50 tasks for automated production of design estimate documentation and 60 automated process control system tasks in the KaSSR Minstroymaterialov.

What return has the economy received from the millions invested in ASU creation? As unpleasant as it is to admit, the fact is that in most cases the costs for procuring computers and introducing ASUS have not been properly justified.

System designers most often have attempted to adapt them to the existing structure, methods and procedures of management. Such attempts to "adapt" the new to the old have been inefficient. Of the systems designed, there is presently not one that could be recommended for dissemination.

Designers' initial attempts to make recommendations on restructuring the functional apparatus of trusts, housing construction associations and main administrations (at Mintyazhstroy and Glavalmaatastroy), providing for a move from some old functions to new ones (not completely worked out, untried in practice, without modified instructions), did not meet the needs and conditions of production, and were not used.

It was recommended that calendar planning, weekly and daily dispatcher planning and construction management schedules, logistics, current accounting and others be done in a machine version. However, this idea failed to consider that no one had changed the existing order for accounting and reporting (in the same way that no one had changed the functions of management workers). The result was that the employees basically were supposed to carry a double load: to perform ASUS-related work along with their customary job duties. In place of lightening their functions and escaping routine work, they began to drown in the routine itself.

This is only one shortcoming of the preproject stage of system creation. It is related to the fact that the organizational and economic activity of construction subunits is studied very superficially. And it's not just a matter of negligence. There simply aren't enough specialists to perform such work properly at the necessary level, either among the designers, or the customers: builders and assemblers.

Another factor is that really serious attempts have not been made to change the information basis of management, to restructure accounting methods to transfer the document flow to machine media. The work is unquestionably complicated. It involves changing document forms, organizational structures and personnel, and requires redesigning management procedures and jobs, and new management rules. But it had to be done.

Managing construction with the ASUS requires reworking a large amount of information, using punch cards, magnetic tapes, disks and so forth instead of the usual (paper) documents. Traditionally, the incoming and outgoing documents are written on departmental blank forms, signed by directors, and where necessary certified by the administration's seal. Such documenta cannot be directly used for machine processing.

Moreover, many documents cannot be understood by users without appropriate additional decoding. They cannot be supplied as a report or sent to another organization.

Several systems (especially the ASUS developed by the Kazakh branch of the Scientific Research Institute of Systems for Mintyazhstroy and Glavalmaatastroy) not only failed to provide economic efficiency, but stopped being used altogether, so their production costs were wasted. In addition to all that, creating computer centers and ASU departments in Minstroy helped increase the number of management personnel overall, and naturally the cost of maintaining them.

For instance, in Mintyazhstroy in 1981, the number of employees per million rubles of construction and assembly work grew from 130 persons to 133 over 1975, while the number of workers remained the same (110). Yet the proportion of administrative and management people grew by 15% (from 20 to 23 per one million rubles of construction and assembly work). At Glavalmaatastroy, the number of employees grew from 156 to 167, while that of workers dropped from 111 to 103; in the AUP, there was a 5% growth, from 20 to 21. In brief, automating management work did not free managers, but increased their number, which can hardly be considered normal.

Other flaws appeared as well. ASUS designers and specialists often had a superficial approach to solving a problem. The systems were initially introduced with insufficient organizational and economic preparation on the part of construction subunits. Frequently, the desired goal in creating the automated enterprise control system was basically acquisition of the computer. Some people naively assumed that electronics would "rescue" them from all problems. But no computer, of course, can either replace or eliminate the need to have appropriate design budget and organizational documentation, optimized plan versions based on available material and labor resources, efficient technology and work organization corresponding to specific conditions.

The so-called "psychological barrier" also has yet to be surmounted. On the one hand, it is felt by directors and specialists at many construction organizations who are inclined to think that the plan can be fulfilled without any ASU, as long as there are enough materials. But even where management automation is not rejected outright, the work is often shifted completely onto the shoulders of a special group of people, which the directors most often remove themselves from. This is no better than a frank rejection of automated systems. And worse is possible: large additional resources are spent, without any return.

There are other ways in which the new is resisted. Authoritative directors often feel that the system constricts them, and denigrates their personal role. Unquestionably, ASU, voluntarism and arbitrariness are incompatible. The actual goal is to raise the director's level, free him from solving routine questions and problems, and concentrate his efforts on the small number of deviations on the critical path. This will enable him to focus his attention on solving fundamental, long-range production questions, not satisfy his ego. There is no room in the system for ambitions, which does not suit everyone.

Others don't like the ASU's objectivity, its evaluation of work according to the level of fulfillment of a scientifically valid plan, not a reduced, subjectively corrected one.

It would be a mistake, however, to reduce everything to such factors. It was stated above that the low quality of designs inevitably create a lack of confidence in automated control systems, which should not be considered unfounded.

It must be admitted that for a number of reasons the main goal of construction management automation has not been solved: creating ASUS that would substantially raise the level of management and the level of managers' labor productivity. Naturally, this would also involve a reduction in their number, as provided by technical and economic considerations. For example, in ten years the Kazakh department of NII sistem of USSR Minpribor has created a whole series of inactive ASUS, whose development cost a good deal. For instance, the cost of three stages of the ASU of the Alma-Ata housing construction association was over one million, four hundred thousand rubles; that of the ASU of the "Almaatazhilstroy" trust, 300,000 rubles; ASU "Almaatastroy", about 200,000 rubles; ASU Glavalmaatastroy, 400,000 rubles; ASU of the trust "Almaatasel'stroy" No 77, 170,000 rubles; ASU of the trust "Kazpromtekhmontazh", 230,000 rubles; and ASU of the Kapchagaysk SSK, 165,000 rubles.

Not one problem of ASU Glavalmaatastroy has been used. The ASU of the Kapchagaysk SSK is still not operating. Only local factory production tasks are being used: for producing large-panel housing construction structures, stocking warehouses at the Alma-Ata housing construction association, and for planning and current management of the trust "Kazpromtekhmontazh".

Involving individual directions of the association's and trust's production and economic activity, they are basically only subsystems and complexes of problems for certain management functions, and cannot be finalized management automated systems.

The material loss is great. But the moral and psychological loss is immeasurably greater; it cannot be estimated by any economic indices.

A superficial approach to ASUS creation by people at the republic's main ASU developer for construction; the lack of training of many construction organization specialists and managers for problem formulation, general participation in project design and system introduction and operation; the uncoordinated actions of individuals; lack of a common goal; difference in indices for evaluating work; and each person's interest in performing only his own job are just some of the factors leading to the negative results in ASUS creation. The most serious lessons must be derived from this.

The ASUS cannot be adapted unthinkingly and primitively to the current production structures and management methods. Organizational changes made have completely confirmed this truth, showing the inadaptability of systems to both existing and changing conditions. Almost 100% of the construction planning, organization and management tasks, forming the basis of the systems, were of an accounting and calculating nature. They lacked optimization and dialog tasks, which are decisive in management. There were no tasks for future development of construction subunits, planning versions, and efficient use of allocated materials and labor for performing economic analysis, generalizations and development of suggestions for future construction work.

Of course, all this should be revealed in the process of ASUS development and introduction. The situation should be analyzed, and measures to eliminate errors noted. Unfortunately, the necessary conclusions still have not been drawn. Yet the negative experience must be analyzed. Otherwise, the grossest and most expensive errors will not be avoided in the future.

It must be recognized with full responsibility that where many construction directors have no faith in the ASUS, designers' skills are insufficient, measures to eliminate uncoordinated actions by individuals have not been planned, and the level of preparation of construction work to work with the ASUS is low, further development of automated control systems is not a simple task, but an extremely complex one, from the organizational, economic and moral-psychological standpoints. And we should not attempt to simplify it.

The principle of "less is better" is obviously applicable here. At least one model working system must be created, and used as a pattern, instead of creating idle ones, spending huge amounts to discredit an idea that is vitally necessary for production.

The introduction of computer technology into construction planning and management is a qualitatively new stage in its development. This is also true of problems of collecting, processing and analyzing information and generating management actions for construction. The general introduction of computers, econometric methods and automated systems in management is not a mechanical, one-time act, but a huge project to improve the economic mechanism, develop the structure of construction organizations, and refine the forms and methods of construction management.

Future development of management automation involves moving from the individual, local problems currently solved to comprehensive ASU of main administrations, associations, trusts and industrial enterprises, encompassing either the basic or all aspects of production and economic activity. They must include the use of design documentation, created considering system requirements and on machine media (producing "Uniform Construction Cards" for each site), as well as organizational and technological documentation (included standard normative technological documentation for logistics, providing for delivery of structures and materials to sites by suppliers, and certificates of construction and assembly organizations and industrial firms and their efficient loading, considering the optimality criteria used).

In the future, the sectoral automated control systems of ministries and departments must be "joined" with the republic automated construction control system (RASUS), the automated design system of design institutes, the automated control system for planning calculations of KaSSR Gosplan, and the automated control systems of Gossnab, the Central Statistical Administration and other departments. Many automated systems still "talk" in different "languages", and do not "understand" each other.

There must also be created a uniform system for computerized storage and processing of data on construction sites, construction organization data sheets, and technological documents. In other words, a normative base of informational data on machine media using a national system of dictionaries, codes and classifiers.

Another, no less important direction in the development of construction, raising the level of its organization and management and of workers' productivity, is the transition to building facilities by flow-line methods, based on general use of the start-to-finish contract production team. It is important that these and other advanced methods be included in ASU under development.

A third direction must be establishment of a direct dependence of work payment for introducing automated control systems on the quality of their operation. The payment must be based not on the time spent by developers, but on the results of their work in the form of actually working ASUS.

There is obviously sense to the idea of having all ASUS developed in the future be evaluated by the directors and specialists of those management levels they are meant for. ASUS technical assignments and projects should also be critically reviewed beforehand in superior organizations, with subsequent approval.

The directors of construction subunits and corresponding functional services must be people who are fully competent in the creation and operation of ASUS systems and subsystems, people who have a feel for novelty. They are the only ones who can be confidently entrusted with the material and technical resources to improve automated methods of planning and management. Naturally, they must also bear full responsibility for ASUS project creation and realization, along with the designers.

9875
CSO: 1863/234

IFAC CONFERENCE ON AI OPENS IN LENINGRAD

Moscow TASS in English 1544 GMT 4 Oct 83

[Text] Leningrad October 4 TASS--The first symposium of the International Federation of Automatic Control (IFAC) has opened in Leningrad today. The symposium on the industrial use of artificial intellect systems is being held with the participation of representatives of research centres of the USSR, the CMEA member-states, as well as Britain, Italy, Portugal, the USA, France, the FRG and Sweden.

Even if a computer is fitted out with 15,000 million transistors (equal to the number of human brain cells) the machine will never reach the creative capacity of human intellect, but will be only able to imitate it in a measure, prominent Soviet cybernetics expert Germogen Pospelov said. Nevertheless, he told the symposium, already at the present-day level of development of electronic computers, it is possible to predict the appearance of computers of new generations, which will be able, without the assistance of intermediaries--mathematicians and programmers--to talk, receive assignments and issue decisions in the oral speech mode on any branches of science. This is particularly topical in connection with the new level in development of production--the creation of integrated industrial complexes, including robotized systems, capable of self-adjusting and producing the most sophisticated products obeying verbal commands.

Addressing the opening session of the symposium, IFAC President Gabor Vamos (Hungary) pointed out the great contribution of Soviet scientists to developing problems of a new generation of electronic computers. To illustrate this he referred to the successful activities of the Leningrad Research Computer Center of the Academy of Sciences of the USSR, which won world-wide acclaim. The research centre has, in particular, developed and widely introduced electronic method of medicinal diagnosing, long-term socio-economic forecasting on the basis of mathematical models and intensive work is carried out on integrated industrial complexes.

The computers of the Leningrad centre are linked by communication lines with many cities of this country and, through Budapest, also with the academies of sciences of the CMEA member-countries, which ensures a most effective use of the data banks accumulated here.

CSO: 1852/1

PUBLICATIONS

TABLE OF CONTENTS OF AVTOMETRIYA, NO 3, MAY-JUNE 1983

Novosibirsk AVTOMETRIYA in Russian No 3, May-Jun 83 p 1

[Text]

Bibliography

6521
CSO: 1863/217

- END -